MASS TRANSPORTATION in MASSACHUSETTS

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Mass Transportation In Massachusetts

Final Report on a

Mass Transportation Demonstration Project

Prepared under the direction of
Dr. Joseph F. Maloney

for the

Mass Transportation Commission

Commonwealth Of Massachusetts

Based on Materials Developed by the
Mass Transportation Commission Staff

and

McKinsey & Company, Inc.,
Systems Analysis and Research Corporation,
Joseph Napolitan Associates, Inc.,
Consultants to the Commission

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Summary

The Mass Transportation Commission of the Commonwealth of Massachusetts has completed a $5.4 million Mass Transportation Demonstration Project, financed by a $3.6 million Housing and Home Finance Agency Mass Transportation Demonstration Grant and $1.8 million of the Commonwealth's funds.

This project included a variety of interrelated service improvement and fare reduction experiments throughout the Greater Boston region and in the urban areas of Fitchburg, Worcester, Pittsfield and Fall River. The experiments were conducted by the MTC with contracts between the MTC and two commuter railroads serving Boston, the Metropolitan Transit Authority, and ten private bus companies. The total number of experiments was 35.

The experiments were accompanied by a systematic collection and analysis of data and detailed studies of the cost of railroad commuter service and in-depth interviews of public transportation passengers.

The HHFA notified the MTC of its approval of the project on October 5, 1962. The first experiment began on December 10, 1962 and the last experiment concluded on March 28, 1964. The final printed report of the project was published in July, 1964.

The purpose of this Project was to provide data, not otherwise available in any reliable form, upon which predictions can be based as to the effects of various service and fare changes, alone or in combination, on transit ridership. In the case of the experiments in the Boston area, which constitute the bulk of the Project, the findings will also directly support comprehensive transportation planning, now being undertaken by the Boston Regional Planning Project with HHFA assistance under the Urban Planning Assistance program, the Mass Transportation Commission, and the Department of Public Works, utilizing highway research funds.

The results of these experiments have assisted the decision-makers of the Commonwealth of Massachusetts in making immediate, as well as long-range decisions regarding transportation planning and financing, by providing reliable and acceptable facts.

On June 18, 1964 Governor Endicott Peabody signed into law a bill creating a new comprehensive mass transportation agency for the Commonwealth of Massachusetts. In so doing, significant improvements in public transportation have been implemented. These are:

- Geographic, financial and administrative expansion of the rapid transit system, rail commuter service and bus service in the Boston Metropolitan Area;
- Authorization for public transportation authorities or agencies in other Massachusetts urban or metropolitan areas;
- Tax relief and reimbursement for school fares for all Massachusetts' bus companies.

Other aspects of the bill include provisions for further expanding the Boston region's transit district, requirements for coordinated planning of public transportation and highway facilities, a system of making fare and service changes, relief from the existing debt and a broad based representation on the new board of trustees. Revenue support for the legislation will be provided by a two cent increase in the state cigarette tax. The bill is the culmination of several years of concern over public transportation, particularly in the Boston region. (See Supplement One to this report, particularly the first section.)

The demonstration findings will also have wide general applicability. The various experiments were regional in scope, extended well beyond the limits of core cities, and included all forms of public transportation. The Project, therefore, provides information on a variety of types of service in areas which differ widely in basic characteristics. The experiments

were conducted under a uniform system of controlled measurement which will facilitate the use of the results by other urban areas.

I. Major Findings (Chapter One)

1. The declining trend in public transportation ridership is not inevitable. It can be reversed.

2. Frequency of service is a more important factor than lower fares in increasing passenger volume on public transportation.

3. Selected, incremental improvements in frequency can be self-sustaining.

4. It is possible to develop a model whereby the costs of alternative rail service levels can be accurately evaluated.

II. Railroad Experiment Findings (Chapter Three)

Demonstration Project experiments were conducted on two of the three railroads serving the Boston Region. Experimental variables were introduced on two of the railroads while the third railroad served as a control. The objective of these experiments was to measure rider response to a variety of service and fare levels, both peak and off-peak, over a period of time long enough to establish definite trends and to eliminate seasonal fluctuations as a variable. System-wide changes (as opposed to variations by line which would have been difficult to measure and control) were used to increase the number of conditions tested.

1. Additional passengers were attracted to railroad suburban service during both peak and off-peak hours.

2. Frequency of service is a more important factor than lower fares, in both retaining present passengers and attracting additional passengers to railroad suburban service.

3. Increases in commuter fares, when accompanied by a continuation of a high level of frequency of service, do not necessarily result in decreases in passenger volumes.

III. Rail Cost Findings (Chapter Four)*

One meaningful way to express a railroad's passenger deficit is in terms of annual cash savings that could be realized if passenger operations were discontinued. To calculate these savings for the B&M and the New Haven railroads, the avoidable cost approach was used. Under this method, the deficit for each railroad was established by subtracting the revenues that would be lost, from the cash costs that could be eliminated, if a defined level of service were terminated.

*This and all cost statements are based upon the analytical cost study conducted for the MTC by McKinsey and Co. described in Chapter Four and in Supplement Two.

The avoidable approach varied markedly from the ICC system of costing used by both railroads to compute passenger service losses.

A. Boston and Maine Railroad

The B&M experiment consisted of three phases, differing as follows:

First Phase

1. 70 per cent increase in service
2. 30 per cent fare reduction

Second Phase

1. Continue 70 per cent increase in service
2. Eliminate 30 per cent fare reduction
3. Introduction of low off-peak fare

Third Phase

1. Readjustment of service, some lines received more, others less
2. Continuation of second phase fare structure

During the first phase (January 1963 - July 1963) the B&M passenger deficit was $3.1 million annually. This figure is the net of expected revenue losses of $4.3 million and estimated cash cost reductions of $7.4 million, if the experimental level of passenger service were discontinued. In the second phase, (August 1963 - December 1963) however, revenue increased to an annual level of $4.9 million, based on September and October 1963 results, without an increase in costs (leaving a $2.5 million deficit). Since this level of revenue was further slightly increased in the third phase, (January 1964 - March 1964) accompanied by a slight decrease in costs, the cash deficit for B&M maintenance of the third phase level of service and fares has been calculated at $2.0 million (annualized).

Even under unfavorable circumstances, the B&M could reduce its annual cash drain from passenger service below the level of the second phase deficit ($2.5 million) during the first year of discontinuance. Thus, the B&M would not face the problem of an unacceptable impact on its cash position because of immediate revenue losses and delayed cost eliminations.

Increased service will not eliminate or significantly reduce the current deficit. Although increased service improved patronage, the incremental costs of providing that service were barely offset by revenue increases in the third phase (annualized).

Fare increases cannot be expected to offset the deficit because the large increase required (about 50 per cent, based on 1963 deficit of $2.5 millon on $4.8 million revenue) would undoubtedly produce a significant drop in patronage. On the basis of experiment results, more reasonable fare increases might not materially affect patronage and, hence, could provide

substantial help.

Together, these findings point to the need for outside support of the B&M passenger service if it is to remain in operation. The B&M cannot afford the present cash drain from its commutation service. In view of the B&M's strained financial condition, its minimal cash reserves, its heavy capital debt payments, and its recently declining freight revenues, service reduction and fare increases do not, in themselves, offer a practical alternative to discontinuance.

B. New Haven

The New Haven's East End passenger service deficit, calculated by the same method as the B&M's, is $0.7 million annually. This figure is based on expected revenue losses of $2.0 million and anticipated cost savings of $2.7 million, if the experimental level of passenger service were discontinued. Lost revenues do not include about $300,000 from East End commuters who ride the through trains on the Boston-Providence Line. These trains would be retained, and it is reasonable to assume that their commuter patronage would continue.

C. New York Central Suburban Service to Boston

Because the New York Central did not participate directly in the experimental patterns of the Demonstration Project, it was not possible to calculate precisely the revenue losses and cost savings that would result if the New York Central suburban service was discontinued. However, an overall look at the Railroad's Boston commuter operations suggests that avoidable costs would likely be confined largely to above-rail expenses for crews, fuel, and equipment maintenance. Two factors in particular lead to this conclusion:

1. The Boston commuter service does not constitute a significant part of the New York Central's total operations. Hence, discontinuance of this service would have little impact on supervisory positions or facilities such as shops and enginehouses.

2. The line used by the commuter trains also handles through freights and the through-passenger trains to Chicago. Therefore, facilities modifications would be limited.

D. General Findings

System semi-fixed costs, which constitute more than a third of total railroad expenses, do not vary directly with volume and, hence, produce a cost curve which rises rather sharply and then levels off. As a result, incremental costs at higher service levels are limited primarily to variable costs and therefor, do not rise in proportion to volume. For example, a 70 per cent increase in service from the pre-experimental to experimental levels required only 20 per cent in additional costs.

The heavy proportion of total costs not directly assignable to individual lines (42 per cent) makes local community support of commuter service difficult to establish on an equitable basis. To assist with this problem, allocation methods for all system fixed and semi-fixed costs have been included in the cost model. However, these methods are necessarily somewhat arbitrary and the percentage assigned to each line can change markedly depending on the makeup of the overall system.

IV. Findings Based upon Private Bus Company Experiments (Chapter Five)

Private bus company experiments were conducted by companies with fleets varying from two to 320 buses through numerous types of urban and non-urban areas under a wide range of fare and frequency alterations. Testing as many combinations of these factors as possible was the basic objective.

A. Suburban Service to the Core

Carefully selected service improvements from suburban communities to the downtown core of a major urban regional center can be self-sustaining.

B. Suburban Service to Small Cities

In several new and increased service experiments between suburban communities and the city centers of smaller urban areas, the cost of the improved service greatly exceeded the incremental fare-box revenue.

C. Feeder Service

New bus feeder service from densely populated urban areas to rapid transit stations was economically feasible. Feeder services from low density suburban communities to railroad stations where direct service to the major regional city core was provided, were not economically feasible.

D. Local Service in Small Urban Areas

Carefully selected local service improvements in smaller urban areas can be self-sustaining.

E. Direct Service to Industrial Plants

Special service during peak hours to industrial plants, which have free and available parking for employees, did not recover operating costs from fare-box revenue unless the equipment and operator was otherwise available and not utilized. In rare instances, incremental direct operating costs may be recovered.

F. Off-Peak Fare Reduction

Off-peak fare reductions by themselves did not generate sufficient new ridership to offset reductions in revenue.

G. Costs

In private bus company operations, the greater portion of costs vary almost directly in proportion to miles operated, with only a minor portion of total costs being fixed costs.

V. Findings Based upon MTA Experiments (Chapter Six)

Experiments with the MTA were limited to testing specific improvements in bus transportation along chosen travel corridors. No attempt was made to introduce variables in the well-patronized and profit-making rapid transit system. The basic purpose was to gather data for each of several types of routes so that results could be applied to all similar MTA routes regardless of location.

A. Downtown Distribution

Increases in frequency in local service completely within the downtown district of Boston were self-sustaining.

B. Increased Off-Peak Suburban Bus Feeder Service

Increased off-peak suburban bus feeder service through a low density residential area to a rapid transit terminal with frequency increased from ten to five minutes, produced no appreciable increase in ridership.

C. Circumferential Service

In the major city of a major urban region, as distance from the city center increases, circumferential bus service becomes more attractive to a larger number of people. More precisely, as the distance from downtown increases, traffic congestion decreases, permitting higher bus operating speeds. In addition, as distance from downtown increases, the time required to travel downtown on radial rapid transit and back out to the perimeter on another radial transit line increases while, for a given length of journey, the bus travel time decreases until a point, apparently about five miles from downtown Boston, when circumferential bus service becomes faster than rapid transit for many destinations.

D. Drive-In Theater Parking and Express Bus Service

The combination of parking at Drive-in Theaters on the fringes of Boston and direct bus service over express highways to a rapid transit station or to downtown Boston produced no appreciable ridership.

E. Parking at Rapid Transit Station

Reduction of parking fees at rapid transit stations with substantial parking vacancies resulted in substantial increases in both ridership and net revenues for the transit operator.

VI. Findings Based upon In-Depth Interviews (Chapter Seven)

As part of the experimental program, MTC staff personnel and consultants carried out surveys and interviews with patrons on Demonstration Project services. The purpose of these surveys was to gain an insight into the habits and opinions of riders, their feelings about public transportation, and their reasons for preferring one transportation mode over another.

A. 85 per cent more passengers were attracted to railroad suburban service from the automobile than from other forms of public transportation.

B. Even with inexpensive and plentiful parking in downtown Boston, mass transit riders who do not use any private transportation getting to the rapid transit line, would continue to use mass transit. Transit riders who drive to and park at transit stations would prefer to drive all the way to Boston if parking were inexpensive and readily available.

C. A majority of bus passengers in both smaller urban areas and Boston constitute a captive market, in that they have some dissatisfaction with the standards of service and have no reasonable alternative form of transportation.

In addition to the Final Report there are four Supplements, designed to present detailed analytical data by which the findings of this Project have been established. The First Supplement is "The Boston Region", a preliminary survey and analysis of the Greater Boston region, previously completed by the Commission with the assistance of an Urban Planning Assistance Grant (Mass. P-24). The remaining Supplements are detailed presentations by three consultant firms to the Commission for this Project. The Second Supplement has been prepared by McKinsey and Company, Inc., who have performed the analysis of the costs of railroad commuter service. The Third Supplement has been prepared by Systems Analysis and Research Corporation, and contains extensive statistical presentations of results of all the individual experiments and cost analyses of the private bus companies and a discussion of MTA costs. The Fourth Supplement has been prepared by Joseph Napolitan Associates, Inc. and is a presentation of the in-depth market survey of the actual patrons of the Demonstration experiment, including an analysis of varying characteristics and expressed preferences for the different passenger groups utilizing railroad, bus and MTA facilities.

Chapter One

Background

I. Background

A. The Mass Transportation Commission

In 1959, the Governor and the General Court in Massachusetts recognizing the necessity of obtaining coordination and cooperation in comprehensive planning for both public and private transportation, established a new state agency, the Mass Transportation Commission.

In both form and substance the creation and operation of the Mass Transportation Commission is Massachusetts' unique response to the intricate problems of regional development and transportation. The agency has an unusual structure; it is in part an inter-agency organization through the ex-officio membership of the heads of six major state transportation agencies: the Metropolitan District Commission, the Metropolitan Transit Authority, the Massachusetts Turnpike Authority, the Massachusetts Department of Public Works, the Massachusetts Port Authority, and the Boston Traffic and Parking Commission. At the same time, it is a public agency through its five citizen members, appointed for three-year terms by the Governor with the consent of the Executive Council. It is also unique in substantive functions: the MTC not only acts as both a formal and informal consultative body and problem solving center for its member agencies but it also serves as a technical advisor to the State Legislature and to the Executive Department of the State Government.

The Mass Transportation Commission is charged by statute with the responsibility of investigating and studying the

> . . . relationship of mass transportation facilities, land use and urban renewal and development to the economic needs and opportunities of the Commonwealth.
>
> . . . with particular emphasis on the financial, legal, economic, technical and social problems. The commission shall study and plan for coordinating the highway program of the Commonwealth and the federal government with other mass transportation facilities. The commission shall work with appropriate federal agencies and agencies of the commonwealth in connection with highway, transportation, land use and urban renewal and development studies. The commission shall from time to time make such recommendations to the governor and the general court for the coordination of highway and mass transportation programs and for the development of integrated plans for mass transportation and land use as the commission may deem it advisable.

To establish a firm basis for a comprehensive development plan for the greater Boston region, the Mass Transportation Commission undertook a preliminary survey and analysis of this region. The final report from this survey and analysis has been published as "The Boston Region" and is the first Supplement to this Demonstration Project Final Report.

This survey indicated that there was inadequate information available to the decision makers and to the public to provide a basis for allocating funds for major capital investments in transportation facilities. Additional information was

needed to enable the community to make at least one major transportation decision. With the prospect of early termination of all rail commuter service the Commonwealth would be faced with the alternatives of marshalling additional public support for commuter lines or permitting outright abandonment. Realistic information on railroad revenues and costs (including the effects of fare reductions and service increases) and on the cost and benefits of available alternatives was necessary before a prudent policy could be formulated.

At the request of the MTC, the Legislature in May 1961 established a Joint Special Legislative Committee on Transportation, consisting of the chairmen and other members of the regular legislative committees on transportation and metropolitan affairs. The Committee was directed to work in cooperation with the MTC in the study of major problems of transportation confronting the Commonwealth and to develop a program for solution of these problems. The Executive Director of the MTC was appointed secretary to the Committee and the staff of the MTC carried out studies for both bodies. During the summer and fall of 1961, the members of the Committee and Commission reviewed the material being developed in the Boston survey and special MTC staff studies. In December 1961 the Chairman of the Committee and the Chairman of the MTC issued a joint statement recommending that the MTC undertake what became the $5.4 million mass transportation demonstration project and its companion, what is now known as the Boston Regional Planning Project (BRPP).

In January 1962. a voluminous report, (House 3400) was filed on behalf of the Committee and Commission with the General Court. This report was the basis of the original MTC application for a mass transportation demonstration grant.

The report stated that mass transportation problems could not be effectively dealt with on a piecemeal or local basis. The interactions and complications were too widespread and entwined to permit anything but an integrated long-range approach.

These reports noted that the public transportation services then available to the Commonwealth were all in a dangerous state of ill-health and decline. The shift away from the use of public transportation and toward increasing reliance on the private automobile even for interurban traffic had seriously endangered property values, land use patterns, municipal costs and other aspects of the regional economy and welfare. In particular, the continuing increase in the use of private automobiles for individual commuting and personal shopping trips had resulted in growing impediments to economic activity and vitality in the inner core area. The greater Boston region was served by three commuter railroads whose lines extended to its outer limits, but these same railroads were under substantial pressure to abandon completely their commuter services within the Commonwealth.

Outside the city of Boston many of the cities and towns of the metropolitan region and throughout the entire Commonwealth were in danger of steady decreases, and, possibly, eventual abandonment of their only form of public transportation, a private bus company with a charter as a common carrier. Several of these private bus companies had been experiencing steadily diminishing profits. Some of these companies would be forced to abandon their service unless their passenger revenues were increased or they received governmental relief. In 1960, the major private bus companies in Massachusetts had a combined operating ratio of 95 per cent, i.e. they were spending 95¢ to produce $1.00 of revenue*. Information gathered by the Mass Transportation Commission indicated that the operating ratios for 1962 would probably be considerably worse than in 1960. The financial position of the private bus industry as a whole and many of the leading companies in particular was becoming precarious. Some of the companies had survived partially because of their sale of garages and other real estate, a type of profit not consistent with a continuation of passenger service at present or improved levels.

This committee report summarized what the Commission and Committee believed to be the most immediate need in transportation:

> We must resolve certain questions *before* basic public policy and priorities can be established in the mass transportation field, although we can easily identify the most fundamental aspects of the mass transportation problem. *The most critical need is to establish beyond all resonable doubt a body of reliable information sufficient to serve as the basis for a broad community concensus. Only within the framework of this tested information and community concensus can the General Court and the Governor reach agreement on a particular public policy and specific priorities for a far-reaching, comprehensive mass transportation program.*
>
> It is clear that in order to provide the basis for such a consensus there must be comprehensive analysis of the alternative courses of action now open to the community. This analysis must include *conclusive, controlled experiments* in the entire field of mass transportation, *designed to field test methods and cost of all the various alternatives.*

In order to establish the needed body of reliable information the report specifically recommended that the Commission undertake a mass transportation demonstration program that was outlined to include approximately $4. million in railroad experiments, $500,000 in experiments with private bus companies throughout the entire Commonwealth, and approximately $900,000 for experiments with the Metropolitan Transit Authority.

B. Purposes of the MTC Demonstration Project

Dr. Robert C. Weaver, Administrator of the Housing and Home Finance Agency on October 5, 1962, officially informed Dr. Joseph F. Maloney, Executive Director of the Mass

*Operating ratio is the ratio of costs to revenue

Transportation Commission, that the HHFA had approved the application of the MTC for the mass transportation demonstration grant. In his letter of approval Dr. Weaver summarized the purpose of the Demonstration Project:

> The purpose of the project is to provide data, not now available in any reliable form, upon which predictions can be based as to the effects of various service and fare changes, alone or in combination, on transit ridership. In the case of the demonstrations in the greater Boston region, which constitute the bulk of the project, the findings will also directly support the comprehensive transportation planning, underway with assistance from this Agency under the Urban Planning Assistance Program and from highway funds.
>
> It is expected that the results of these experiments will enable the decision-makers of the Commonwealth of Massachusetts to make immediate, as well as long-term, decisions regarding transportation planning and financing which are based on reliable and acceptable facts.
> The demonstration findings will also have wide general applicability. The various experiments are regional in scope, extend well beyond the limits of core cities, and include all forms of public transportation. The project will therefore provide information on a variety of types of services in areas which differ widely in basic characteristics. The experiments will be conducted under a uniform system of controlled measurement which will facilitate the use of the results by other urban areas.

C. Public Awareness of MTC Demonstration Project

The publication of the joint report of the Recess Committee and the MTC initiated extensive coverage by all news media of the proposal, processing and final approval of the MTC Demonstration Project.

The publication of the above mentioned joint report was front page news in all the Boston press and a major story in all of the leading newspapers serving over two-thirds of Massachusetts population of three million in the Boston region for several days. Radio and television news programs also featured the proposal and several interviews were telecast of the Recess Committee Chairman, the MTC Chairman and various public officials, all giving unqualified endorsement to the program. The fact that the initial publication of the joint report included strong endorsement by the then Governor John A. Volpe, the Honorable John W. McCormack, Speaker of the United States House of Representatives, Mayor John F. Collins of the city of Boston, Attorney General Edward W. McCormack of Massachusetts, and other leading public officials and private citizens, quickly led to strong editorial support and endorsement as well as extensive news coverage.

Participation by the MTC in the project required a substantial appropriation of state funds. In the legislative history of this appropriation again there was extensive coverage by the press and all other news media accompanied by strong editorial support. At the critical stage of the legislative process the press gave repeated and in-depth coverage. The Railroad Brotherhoods and various civic groups organized massive letter writing campaigns resulting in members of the legislative Ways and Means committees receiving hundreds of letters, and phone calls. Some thousands of letters descended upon members of the General Court during the key days of the legislative process.

The legislative committee hearings both on the report of the Joint Committee as well as the separate appropriations for MTC participation in the project were the occasions for repeated front page stories on the proposed project, its objectives and the major experiments.

The approval and appropriation of funds for MTC participation in the Demonstration Project was heralded as one of the major accomplishments of the Legislature in 1961.

Consequently the general public, and especially the railroad commuting public, was unusually well acquainted and familiar with the objectives and major portions of the Demonstration Project even before formal Federal approval of the application for the $3.6 million mass transportation demonstration grant in September 1962.

After the program had been officially approved in 1962, and as part of the Commission's obligations for the successful conduct of this program, the MTC undertook and maintained an extensive community relations and public information program.

The newspaper coverage of the Demonstration Project throughout the experimental period has been tabulated by the MTC staff. Each item, both news and photographs, appearing in Massachusetts newspapers was included and measured in this tabulation. The total amount of space devoted to the MTC experiments was over 50,000 inches which, depending on the yardstick used, could represent a half million dollars. This dollar value of newspaper space does not include consideration of one complete rotogravure section of a Boston Sunday paper, several lead articles in Massachusetts magazines, the feature articles in several magazines of national prominence with considerable circulation in Massachusetts, or radio and television news coverage and other special programs in which the Demonstration Project was prominently featured.

This successful community relations and public information program by the MTC was supplemented by the contractual requirements of the individual carriers to spend specific sums advertising experimental services. The total of the advertising requirements in the various carrier contracts was $43,580, slightly less than one per cent of the total dollar value of the MTC Demonstration experiments.

Except for the railroads, not a single carrier participating in the Demonstration Project had advertising as an impor-

tant item in its normal operating budget. It was only because of the stimulation of the MTC staff that several of the carriers were persuaded not only to accept the contractual obligation to advertise, but also to live up to this contractual obligation. There was no sophistication or extensive knowledge of advertising techniques on the part of the operating personnel of most of these carriers. Therefore the advertising purchased by these carriers, in addition to being small in quantity compared to the publicity, was of an unspectacular, unimpressive and probably unsuccessful nature.

Fortunately the tremendous amount of publicity, including the frequency and repetition of coverage of individual experiments as announcements were made that agreement had been made to undertake the experiments, contracts signed, that the service was about to start, that the service had started, and then the first announcements of the results of the experimental service — all helped in insuring a high degree of public awareness of the nature and objectives of the Demonstration Project. A private commercial corporation could not expect to receive such a substantial return in public awareness of a new product from the comparatively modest direct appropriations for advertising, community relations and public information purposes. The extent of public awareness can be seen by the fact that in the first month there was approximately a 20 per cent increase in patronage of the B&M and of 10 per cent on the New Haven.

Also, as part of its community relations program, the MTC staff conducted approximately 175 public or semi-public meetings with community leaders to stimulate interest in and understanding of the Demonstration Project.

1. Rail Experiments

a. Media Coverage

Since the rail portion was over 60 per cent of the total Demonstration Project, the greater portion of newspaper coverage of the initial proposal, processing and approval of the project was concerned with the rail experiments.

Governor Endicott Peabody assisted the Commission in obtaining extensive news coverage by personally greeting the commuters on the first day of the B&M experimental service. The fact that service was about to begin was a page one story for several days. After the experiment was underway the initial results were also page one stories for several days, and as time went on, weekly and later monthly tabulations of passenger volumes were feature stories receiving prominent treatment.

The dollar value of the newspaper space exceeded $250,000. The media of radio and television were equally generous with their coverage, but an actual calculation of the market value of their time has not been practical.

The initiation of the railroad experiments were also feature stories on the front pages of the daily and weekly newspapers published in the communities in which the commuters resided. The spectacular improvement in service, especially that of the B&M portion of the program, also received an enthusiastic word-of-mouth advertising, considered the most favorable kind by many marketing analysts.

b. Advertising

The MTC contract with the B&M required the railroad to spend $23,000 for advertising the experimental service and fares. This was about one per cent of the total B&M contract of $2.5 million. The MTC staff worked closely with the B&M staff charged with spending these advertising dollars. The program included an "ad" campaign in the metropolitan Boston papers, an extensive program in the weeklies along the B&M routes and an impressive billboard campaign along the main Boston arteries to remind the motorist that he could be there now by train instead of being stuck in traffic. During the second and third phase of the experiment the total advertising budget was spent on small MTC designed pocket-size timetables. These proved so popular that three printings were necessary and over 268,000 timetables were produced.

The total amount allocated for advertising by the New Haven Railroad under the MTC contract was $4,000. By agreement with the MTC staff, a high percentage was spent in local newspapers, that is, in advertising in suburban residential communities of the existing and potential commuters.

The balance of the New Haven advertising budget was spent during the initial days of the experiment in spot announcements on nine Boston radio stations. These spot announcements were included in traffic reports that were broadcast in rush commuter periods from a helicopter over the major Boston arteries. The announcer was instructed to urge his listeners to try the railroad after reporting heavy congestion on roads approaching Boston in the New Haven commuter territory.

2. Bus Companies

a. Media Coverage

The individual experiments in the bus portion of the Demonstration Project did not demand the same repeated front page coverage as that given to the more spectacular and much larger railroad experiments. However, the announcement of the signing of each individual contract received considerable coverage in the local daily and weekly papers and local radio stations in those communities in which the bus experiments were conducted. While an exact statistical computation is not practical, the dollar value of this coverage was in most cases greater than that of the direct advertising expenditures.

b. Advertising

The total advertising requirements of all carriers participating in the bus portion of the Demonstration Project was $8,080. The MTC staff was able to persuade several of these companies to make what was for them their first expenditure in advertising their own services. Even after these contractual obligations were assumed, several of the operators had considerable difficulty because of their inexperience in developing even a small advertising program. Only one of the

private bus companies — the Eastern Massachusetts Street Railway Company — made use of professional assistance in planning and carrying out its advertising obligations. The smaller bus companies being for the most part marginal operations had given up advertising as a way of controlling costs. Therefore, long established inertia of private bus companies in the field of advertising was such that some portion of the very limited amount required by contract was actually never expended. While this reduced the Commission payments to the carriers correspondingly, the result was to indicate a need for the infusion of modern business-like awareness of the value of the use of modern marketing techniques for the private bus industry in Massachusetts.

3. MTA

a. Media Coverage

The announcements of intended improvements in MTA service received repeated and extensive front page coverage in the Boston newspapers as well as the press in the thirteen other communities constituting the MTA district. As with the railroad experiments, although to a lesser degree, the initial results of the individual MTA experiments received widespread front page coverage in the early days of each experiment and subsequent weekly and monthly reports of experimental results also received feature coverage. Approximately 15 to 20 per cent of the free newspaper coverage received for the entire Demonstration Project was directly concerned with the MTA experiments for an approximate value of $65,000-$85,000.

The radio and TV stations were correspondingly generous with extensive and repeated mention and coverage of the MTA experiments.

b. Advertising

The initial contracts for experiments with the MTA contained no provisions for advertising. For many years the MTA had no established program of promotion for any one of its separate routes or types of service. MTA advertising had been generally restricted to that of an institutional nature, encouraging patronage of the system as a whole.

And for the past several years the MTA made no provision in its regular operating budget for advertising. Some space in their own vehicles, however, had been utilized for general promotional advertising without any appropriations for such appearing in the operating budget.

Subsequent contracts with the MTA provided for a total of $8,500 for advertising. As with the B&M advertising program, the MTC staff recommended to the MTA that a substantial portion of this advertising allotment be spent on the distribution of special timetables for the experimental service. These proved highly successful and although there were some 135,000 copies printed, supplies were quickly exhausted by repeated requests by the general public. This MTC initiated effort has launched the MTA into a massive timetable program. At this writing they have produced timetables for 122 of their routes, and after three weeks are having to reprint them to keep up with the demand.

TABLE 1

FINANCIAL SUMMARY OF
MTC DEMONSTRATION PROJECT

PROJECT BUDGET		
Housing & Home Finance Agency	$3,600,000	
Commonwealth of Massachusetts	1,800,000	
		$5,400,000
EXPENDITURES*		
Railroads		
Boston & Maine	2,500,000	
New York, New Haven & Hartford	900,000	
		3,400,000
Bus Companies		
Lynnfield Community, Inc.	3,000	
Service Bus Lines, Inc.	8,000	
Mass. Northeastern Transportation	15,000	
Fitchburg & Leominster St. Rwy. Co.	55,000	
The Short Line, Inc.	65,000	
Brush Hill Transportation	15,000	
Barre Bus Co.	3,000	
Yellow Coach Lines, Inc.	10,000	
Eastern Mass. St. Rwy Co.		
Lowell	8,000	
Fall River	17,000	
Topsfield	16,000	
Lawrence	41,000	
Reduced Fares I	106,000	
Reduced Fares II	33,000	
		395,000
Metropolitan Transit Authority	750,000	
		750,000
Consultants		
Systems Analysis & Research Corp.	90,000	
McKinsey & Company, Inc.	135,000	
Joseph Napolitan & Associates	50,000	
Service Bureau Corparation	13,000	
		288,000
Project Staff Salaries	250,000	
Supplies, Travel, etc.	40,000	
		290,000
		5,123,000
Unexpended		277,000
		$5,400,000

*All expenditures, other than compensation to the railraads, are estimates as of June 30, 1964 and are subject to minor adjustments. All figures rounded to nearest $1,000. Table prepared for comparative, not fiscal, purposes.

Chapter Two

Regional Setting

This chapter summarizes the basic regional characteristics that were the background and framework for the design and evaluation of the Demonstration Project experiments.

Following sections provide a brief outline of the Boston region's population change, land use development, economic history, highway growth and the history of mass transportation. This is important not only to focus on the unique characteristics of the Boston region, but also to provide baselines to permit easy comparison with other regions with transit problems.

Although the experiments were not limited to the Boston region, a majority of the experiments and the expenditure of over 95 per cent of the project funds occurred in the Boston region.

The Boston region was broadly defined for mass transportation planning and study purposes to include all the cities and towns within and bordering the outer circumferential interstate highway Route 495. The arc of this highway is approximately 35 miles out from the city of Boston.

The detailed description of the region is contained in Supplement One: The Boston Region. This study was designed to assemble and summarize information on all major plans and proposals for land use, transportation and related matters in the Boston region. The information and findings served as the basis for the financing and design of the MTC Demonstration Project experiments. Specific chapters dealt with population, land use, economic base, highways, public transportation, railroads, ports and airports. Copies are available upon request.

Similar material for other urban areas in which experiments were conducted are more briefly outlined. No studies similar to the MTC's preliminary Boston survey and analysis have been completed for other areas.

I. Boston Regional Setting

A. Population

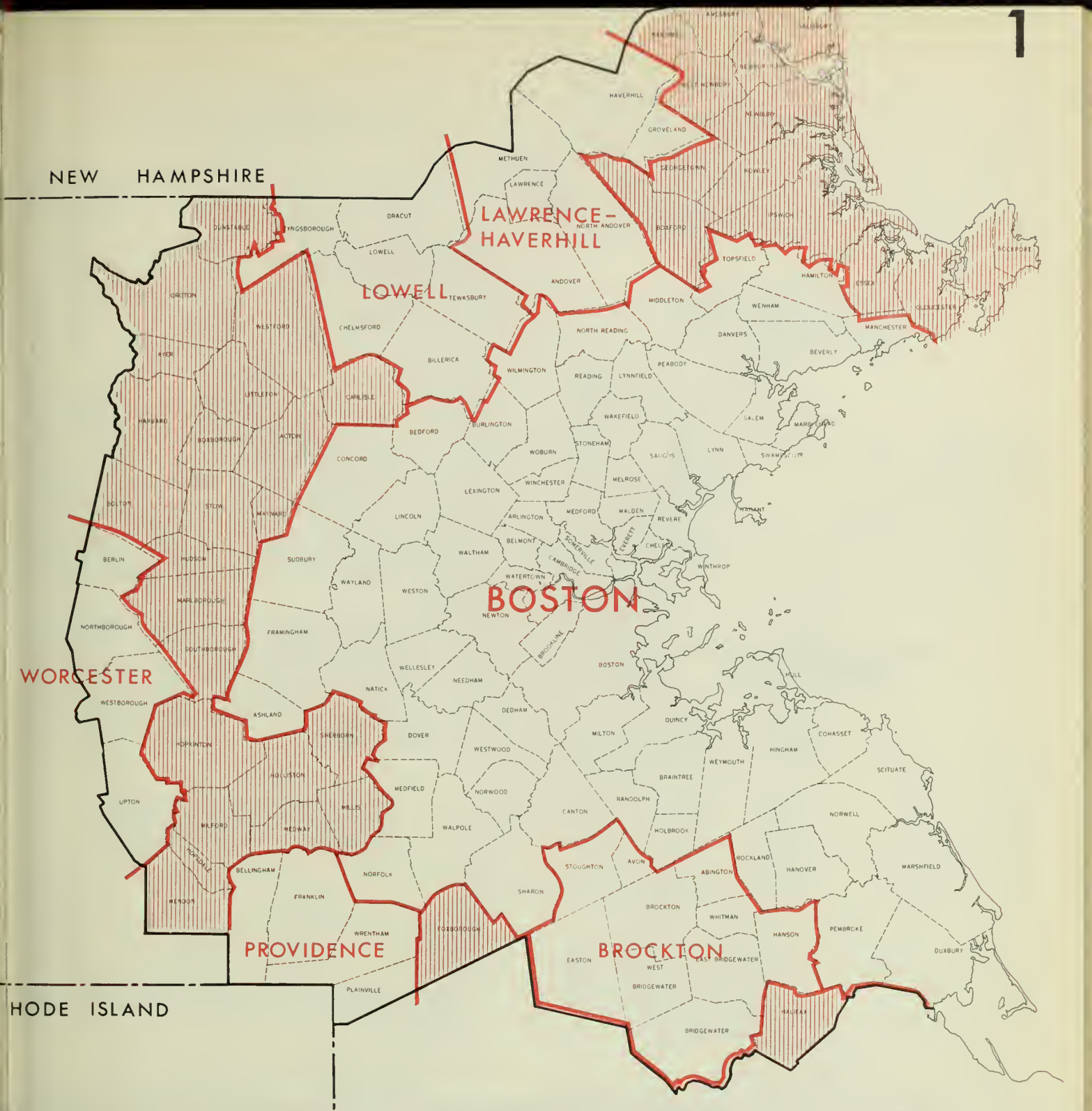
1. General Trends

Population size and growth trends have been widely used as measures of economic and social vitality. In most countries growing economic prosperity and political power has usually been accompanied by rapidly expanding population. In United States communities and metropolitan areas there seems to be a positive correlation between the rate of population expansion and economic growth.

In 1960 the total population of the Boston region was 3.3 million persons, two-thirds of the state population and one-third of the population of New England.

The Boston Metropolitan region is a part of the Atlantic Urban Region, or "Megalopolis", a 400 mile band of nearly continuous urban territory reaching from southern New Hampshire to northern Virginia. This urban belt contains 35 of the nation's 212 SMSA's (standard metropolitan statistical areas as defined by the Bureau of the Census), including New York, Philadelphia, Washington, Baltimore, and Boston in the over-one-million SMSA category, and a dozen others in the 200,000 to 800,000 population range.

As shown in Table 2, the other three metropolitan areas in the Boston region are very much smaller than the Boston



STANDARD METROPOLITAN STATISTICAL AREAS, 1960

AREAS NOT INCLUDED IN SMSA

SOURCE: US CENSUS

NORTH

2560 ACRES
1
SQUARE MILES

0 5 10 MILES

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SMSA. The largest of the three, the Lawrence-Haverhill area (which includes 12,000 people in two adjacent New Hampshire communities), contained a population of almost 190,000 in 1960. Population in both the Lowell and Brockton SMSA's was approximately 150,000. The expanse of territory in the outer parts of the region also includes eight towns on the fringes of the Worcester and Providence SMSA's.

TABLE 2

POPULATION DISTRIBUTION WITHIN THE BOSTON METROPOLITAN REGION BY SMSA's, 1960

Area	Populatian (nearest 000)	Per Cent of Region
Boston SMSA	2,590,000	77.4%
Brockton SMSA	149,000	4.5
Lawrence-Haverhill SMSA[1]	175,000	5.2
Lowell SMSA	158,000	4.7
Remainder of Region	274,000	8.2
Boston Metropolitan Region	3,346,000	100.0

[1]Excluding two New Hampshire towns, Salem and Plaistow, cambined populatian 12,000

Source: U.S. Census of Population, 1960.

TABLE 3

POPULATION CHANGE IN SELECTED BOSTON REGION SMSA's, 1940 to 1960

Area	Numerical Increase 1940-1960	Per Cent Change 1940-1950	Per Cent Change 1950-1960
Boston Region SMSA's			
Bostan	+380,000	+ 9.1%	+ 7.4%
Brockton	+ 39,000	+ 8.4	+24.8
Lawrence-Haverhill	+ 1,700	+ 1.1	− 0.1
Lowell	+ 25,400	+ 2.5	+16.2
Remainder of Boston	+ 82,200	+12.5	+27.0
TOTAL BOSTON METROPOLITAN REGION	+528,300	+ 8.5%	+ 9.4%

Source: U.S. Census of Population, 1960.

The most significant population trend in the Boston region is its comparatively slow rate of expansion. Between 1940 and 1960 the region as a whole increased by only 528,000 persons or about 19 per cent, only about half the national gain of 36 per cent in that twenty-year period.

2. Central City Population Trends

Boston was the third largest city in the nation in 1850 and by 1900 was still fourth in size. However, by 1950 it declined to tenth place and by 1960 slipped to thirteenth. One of the major reasons for Boston's relative decline was its inability to engage in large scale annexation of surrounding territory.

The basic distribution of the region's population has not been fundamentally changed by the continuing trend toward decentralization. A substantial proportion of the region's population continues to dwell in the long-established urban centers.

TABLE 4

SELECTED CENTRAL CITY POPULATION TRENDS, 1950-1960

Central City	Population (in 000's) 1950	1960	Per Cent Change 1950-1960
BOSTON	801	697	−13.0%
Providence	330	288	−12.6
Pittsburgh	667	604	−10.7
Detroit	1,850	1,670	− 9.7
Hartford	177	162	− 8.6
San Francisco	1,160	1,108	− 4.5
Philadelphia	2,072	2,003	− 3.3
Chicago	3,621	3,550	− 1.9
New York	7,892	7,782	− 1.4

Source: U.S. Census of Population, 1960.

Nearly all of the very densely populated communities are served by the Metropolitan Transit Authority. The exceptions are Lynn and Winthrop, both with a density over 5,000 persons per square mile. The only MTA served community with a density of less than 5,000 persons per square mile is Milton. Since a large part of Milton is taken up by the Blue Hills Reservation, in this instance, the average density figure (population divided by total land area) tends to be misleading.

Based on Greater Boston Economic Study Committee projections, the locus of the region's population growth is expected to shift increasingly to the outer suburbs, which are projected to 1970 to grow by 21 per cent over 1960, slightly greater than the gain of 18 per cent projected for the inner suburbs. (See Table 5)

TABLE 5

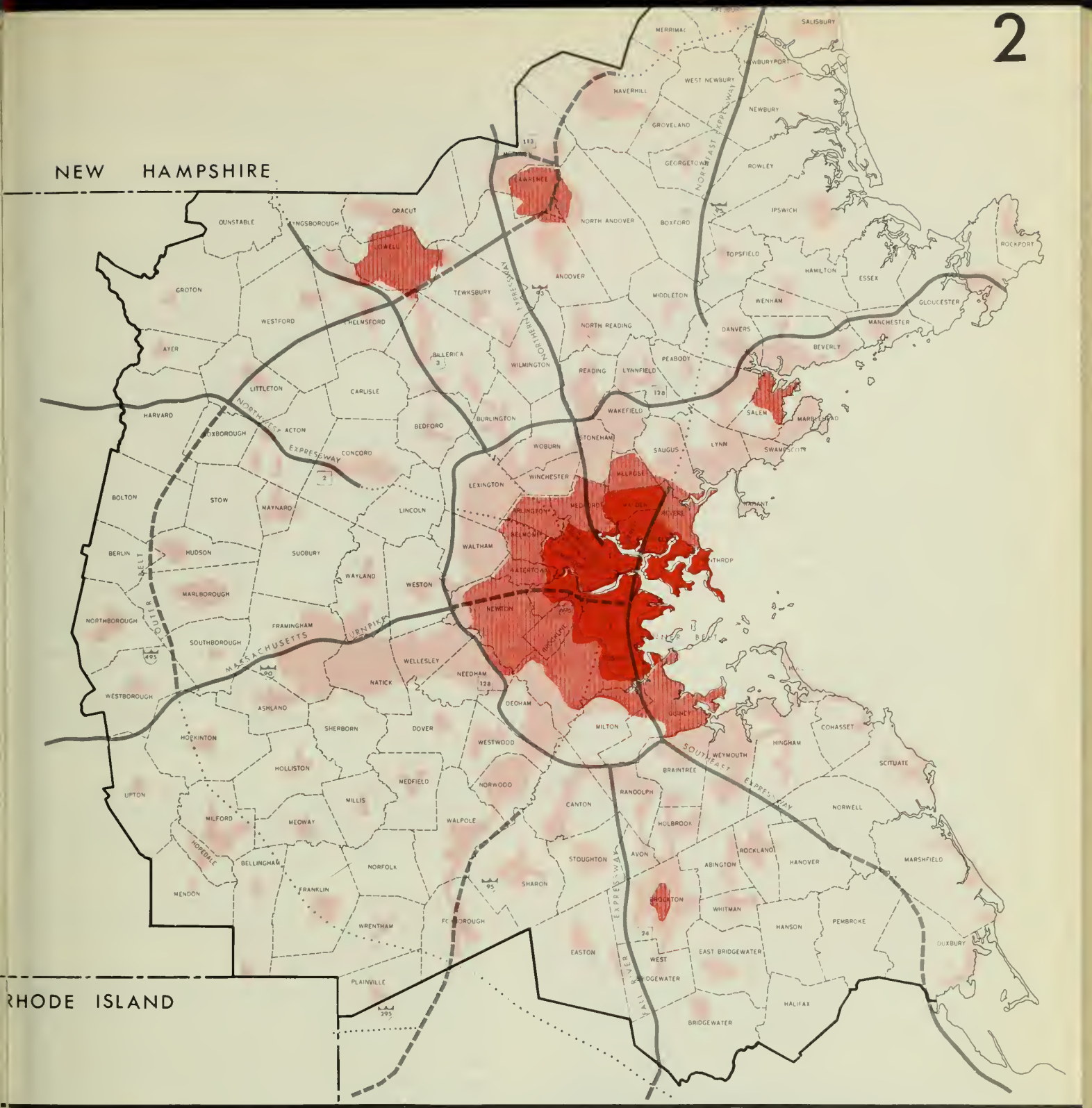
POPULATION OF THE CORE CITIES, INNER SUBURBS AND OUTER SUBURBS FOR 1960 PROJECTED TO 1970 AND 1980

Area[1]	1960	Projected Extrapolation 1970	to 1980
Core	1,303,000	1,209,000	1,124,000
Inner Suburbs	1,028,000	1,191,000	1,381,000
Outer Suburbs	1,405,000	1,338,000	1,619,000
TOTAL	3,436,000	3,738,000	4,124,000

[1]. The care consists af 12 cities and towns, the Outer Suburbs, including Brockton, Haverhill, Lawrence and Lowell, consists af 96 cities and tawns with the total study area consisting of 149 cities and towns.

Source: The 1950-1970 date fram: GBESC, The Papulation of the Cities and Towns af Greater Boston Projected to 1970, Economic Base Report No. 4, (December, 1959) and GBESC, Revised 1970 Papulation Projections of the 149 Cities and Tawns in the GBESC Area, (February, 1961). The 1980 extrapolation is by the MTC planning consultant.

The extent to which this overall pattern of regional population change can or will be altered in the future is one of the important questions facing the Boston region. Continued decentralization will inevitably result in a region heavily dependent on the transportation system to maintain a vital core. It is conceivable, however, that the economic vitality of the core may be damaged by continuing population losses.



POPULATION DENSITY, 1960

- NON-URBANIZED AREAS
- UNDER 5,000 PERSONS PER SQUARE MILE
- 5,000 - 10,000 PERSONS PER SQUARE MILE
- OVER 10,000 PERSONS PER SQUARE MILE

SOURCE: ESTIMATED FROM GBESC AND CENSUS DATA

NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

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B. Land Use

In the three centuries since the initial Pilgrim Settlement, urban development has spread over much of eastern Massachusetts. Much of this expansion occurred within the last seventy-five years, as can be seen in Figure 4, which compares the extent of urbanization in the Boston region in 1885 and in 1960.

1. Historical Development

The pattern of regional land development use was directly affected by land configurations, water bodies, and other major physical features, as well as by technological, economic and transportation developments.

In very large measure, the present basic urban pattern of the Boston region was created by the railroad. The introduction and spread of the railroad (and its outgrowth, the interurban street railway) coincided with the acceleration of urban expansion and the rapid rise of the textile and shoe industries in the region in the period following the Civil War. Urban settlements throughout the region grew up along the railroad and major paths of regional development followed major rail routes. The land use pattern of downtown Boston was strongly influenced by the efforts of various railroads to establish routes and terminals in the water surrounded peninsula of Boston.

Railroads may still be a significant element in shaping the region's land use pattern if one or more of the proposed conversion of rail routes to rapid transit service is approved. Such action would probably result in an increase in density of development along the route, especially near transit stations.

Since the early years of the twentieth century, the self-powered motor vehicle has opened up possibilities of travel in a multitude of directions, and has had a great influence on urban development and land use since World War I.

2. Present Pattern

Among the salient features of the regional land use pattern are the following:

a. Open Character

Although the Boston region is one of the longest inhabited and most densely settled parts of the nation, two-thirds of the region (a million acres out of a million and a half) consists of open land, most of it wooded. Only about a fifth of the total land is residential, mostly single-family residences. Other land uses represent even less significant fractions of the regional pattern. Manufacturing and commercial uses — the chief components of the economic base — comprise only 7.5 percent of all regional land.

The regional development pattern resembles a series of passageways, some broader than others, reaching out to merge with older independent settlements or flowing into open country.

b. Directions of Urban Growth

Only a third of the region's land area had been developed in 1960. While continuous strip development along older roads tends to conceal the open character of most of the region, along new limited access expressways like Interstate 93, most of the adjacent territory is open and undeveloped.

c. Dominance by the Core*

Despite trends toward decentralization, the core area still contains the largest concentrations of most urban land uses. The dominance is marked in multi-family residential, industrial, and commercial uses. The core, which contains only about five per cent of the region's total land area, contains one-third of its industrial and commercial land and two-thirds of its multi-family acreage. There is a heavy concentration of industrial land uses in and around Boston harbor and a concentration of commercial uses in downtown Boston. Because of the multitude of individual communities in the region which are almost exclusively residential in nature, there are entire zones in which most of the labor force must commute ten, twenty, or more miles to work.

C. Economic Base

For almost three centuries the Boston region's economy has alternated between decades of survival and considerable growth. In the process, the region has overcome serious locational handicaps, scanty natural resources and continued out-migration of many of its productive residents. There were few basic natural resources in the region for economic expansion other than an excellent port and a moderate amount of water power on the fringes of the region. Boston's geographic location was and still is a serious handicap. To compensate for these disadvantages, business and financial leadership within the community has consistently demonstrated an ability to adapt successfully to changing conditions.

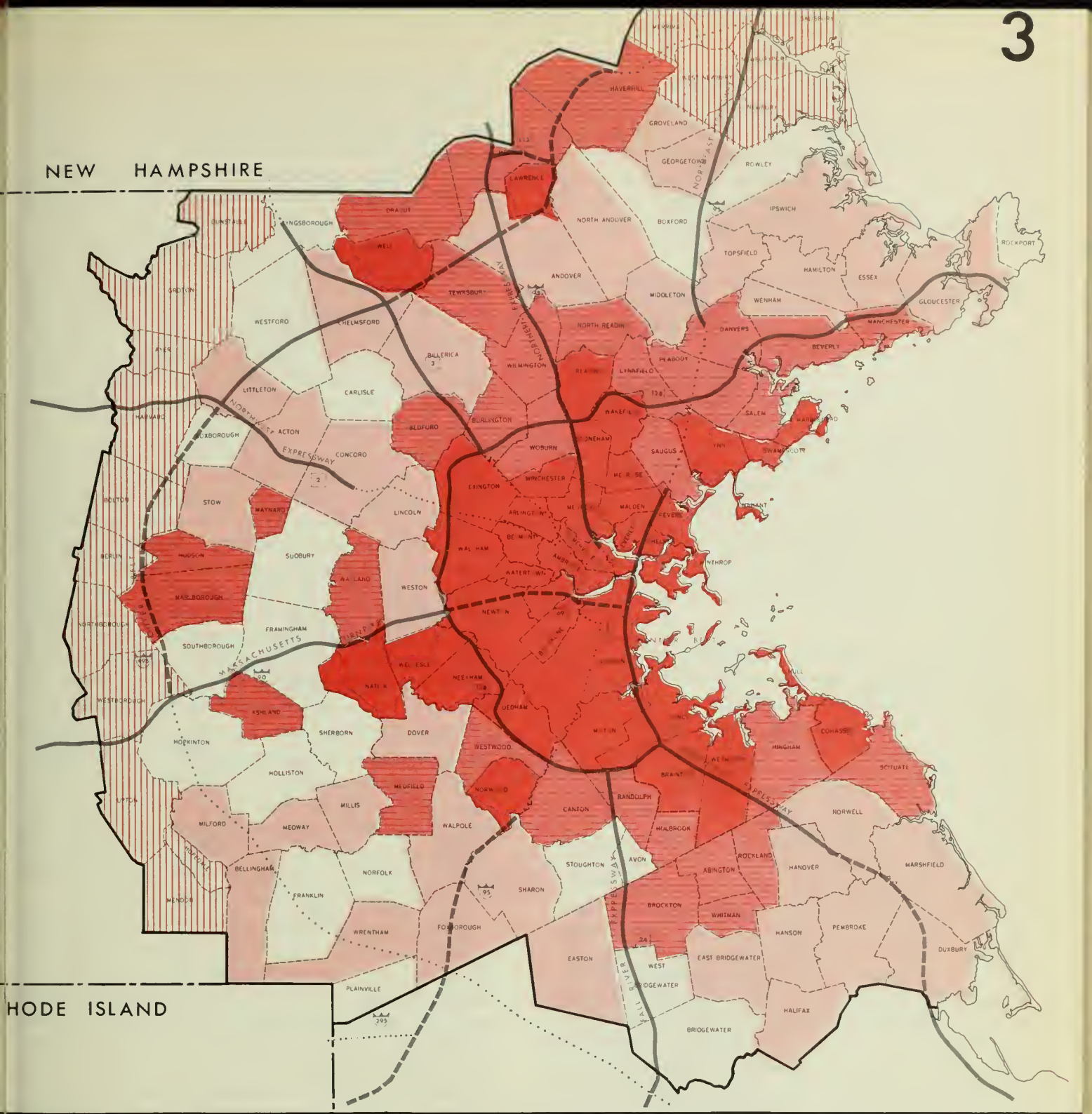
The region's industrial pattern did not change basically between 1850 and 1947. Textiles and textile machinery were still the region's leading industry in 1947 and leather production was still a major part of the post-war industrial scene.

During World War II the region's stagnant industrial base began to change, and the rate of change accelerated shortly after the war's end.

Technological advances, closely associated with research at the area's major universities, resulted in a significant increase in electronics and instrument manufacturing. Growth in these industries gathered momentum through the early years of the cold war, the Korean War, and the space age. In the twelve years from 1947 to 1959 progress in technology and the impact of mammoth defense expenditures helped to create a powerful and rapid expansion in the region's electrical machinery and allied industries sufficient to compensate for a simultaneous attrition in soft goods employment.

The Boston region has long shared with New England the reputation of conservatism and slow growth, yet in the past decade a change has occurred in this image. It is partly a

*Core: Boston, Cambridge, Brookline, Newton, Watertown, Belmont, Arlington, Somerville, Medford, Melrose, Malden, Everett, Chelsea, Revere, Winthrop.



PER CENT OF USABLE LAND DEVELOPED, 1960

- UNDER 13%
- 13 – 24.5%
- 25 – 54.5%
- OVER 55%
- NO DATA

SOURCE: GBESC LAND USE STUDY

NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

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consequence of the industrial growth along Route 128 and because the Boston area weathered the nation's four post war business recessions (1948-49, 1953-54, 1957-58, and 1960-62) in excellent style. Unfortunately, the same cannot be said of the three other metropolitan areas in the region; all are soft goods manufacturing centers which have been battered by cyclical downswings and subjected to long term erosion of their economic bases.

The region's present economy represents a distinct break with relatively stagnant patterns of the past century, when the economy was largely based on low wage industries. The region now has a diversified economic base underwritten by great financial strength and stimulated by pre-eminence in the research and development sectors of international growth industries. As its economy has increasingly shifted to a reliance on intellectual capital, some traditional assets have become less significant. For example, there is no large unskilled labor pool which was one of its strengths in the 19th century and which now can be found in New York, Chicago and in the South. Instead, the economy runs primarily on a cerebral fuel, on the products of its major universities and on the skills and intelligence of a corps of financial, professional and technical personnel ranking with the best in the nation.

Despite the risks involved in its present heavy dependence on federal military and research expenditures, the region is probably on firmer ground than it has been in many years. With one of the nation's largest concentrations of scientifically oriented growth industries and a strong financial and insurance function, the economy of the region promises even greater expansion. While Boston's traditional economic assets — its port, its access to water power, and its pool of low wage labor — faced strong competition from better situated areas, the area's competitive abilities in sciences and finance are not adversely affected by its geographic location or its lack of natural resources. In fact the rapid technical obsolescence created by new discoveries is probably one of the most important factors in safeguarding the region from a future drastic upheaval in employment patterns of the kind which struck its textile and shoe industries. There is a fair degree of assurance that large numbers of jobs for skilled workers as well as for scientists and engineers will emerge from the region's laboratories. The region's research and development and its custom-production electronic industries are not as susceptible to automation as are stable industries in which long production runs are feasible, as in the steel industry in the U.S. or the electric light industry in Japan.

This is not to say that serious problems need not be faced. Unemployment in some parts of the region is far too high, average factory wages are below the national average, further problems are foreseeable in the remaining segments of the region's textile and shoe industries, and competition for science-based installations is becoming increasingly keen.

Despite trends toward suburbanization, the Boston region is still characterized by a very compact pattern of development with most of the population and economic activity concentrated within a ten-mile radius of Boston. However, strong centrifugal tendencies in the recent past, including the suburbanization of housing and economic activities, have weakened this pattern. If these recent trends continue, the core which contained almost half the region's population in 1950 will decline to a third of the total by 1980, a trend which would have marked effects on the economy and other aspects of the development of the region. However, if there is sharp growth in popularity of in-town apartments, the core's share of the region's future population may be significantly larger than if the trend toward single family dwellings in suburban locations continues to dominate the regional housing market.

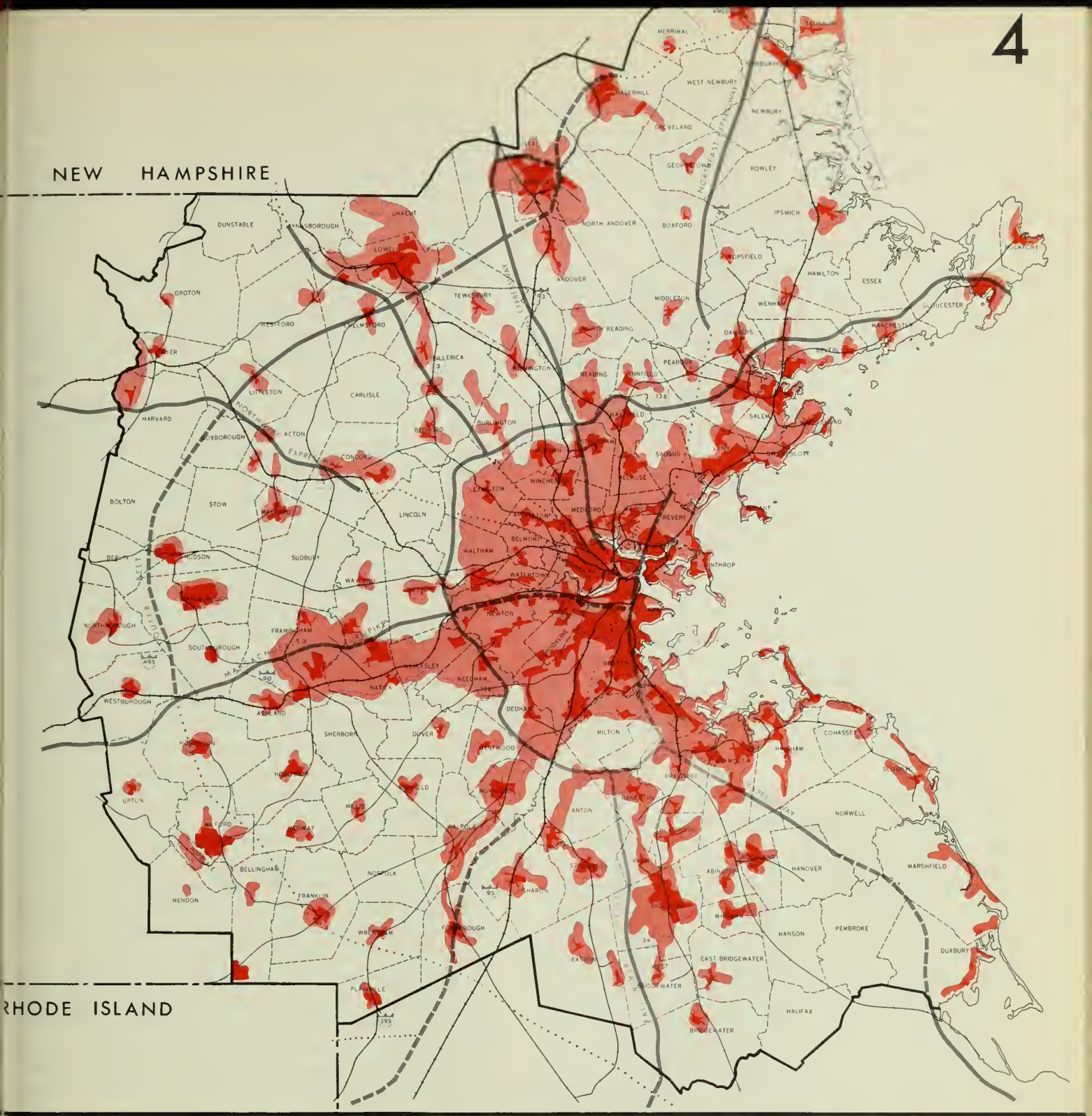
In addition to its attractiveness as a residential area, the future of the core depends in large measure on its attractiveness as a place to work and shop. Centrifugal tendencies in retailing are indicated by the decrease in the proportion of regional retail sales in the Boston CBD,* whose share fell from 15 per cent to only 9 per cent of the regional sales total between 1948 and 1958. A similar but less drastic decline was noted for the city of Boston, which decreased from 37 per cent of the region's 1948 total sales to 31 per cent in 1958. If the recent trend (1954-1958) continues, by 1970 Boston may account for only a fifth of the region's retail sales with only a minor fraction of the total in the Boston CBD.

Between 1947 and 1957 the Boston Central Business District experienced sharper employment losses in manufacturing (down 25 per cent) and wholesaling (down 19 per cent). There were some rays of hope, however. During the same decade, finance employment increased by 14 per cent and services employment by 11 per cent. Numerically, job gains in CBD growth sectors amounted to 9,000 of which over 5,000 were derived from finance and insurance.

Employment change in the Boston CBD is directly related to transportation patterns. The decline in retailing is largely the result of net declines in CBD employees and shoppers entering the CBD. The decline in manufacturing, wholesale and retail activity, accompanied by an increase in finance and service employment, presages an increase in the volume of long-range commuter trips from the suburbs as the ranks of white collar executive and supervisory personnel continue to grow rapidly, however, total CBD trips may decline as the CBD working population diminishes. This growing movement of white collar workers to the CBD is likely to be accompanied by a growing reverse flow of manufacturing employees traveling between core homes and suburban factories.

Core area losses have been concentrated in the city of Boston. In 1947, Boston contained 2.5 times as many jobs covered by unemployment compensation as the remainder of

*CBD: Central Business District.



URBAN DEVELOPMENT, 1885 AND 1960

1885

1960

SOURCE : USGS AND GBESC MAPS

NORTH

2560 ACRES

SQUARE MILES

0 5 10 MILES

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core. By 1960 the ratio had declined to a position of comparative equality with the remainer of the core. Expressed as a proportion of total regional employment, Boston's share diminished sharply between 1947 and 1958 but levelled off between 1958 and 1960. In both periods Boston's major losses were caused by decreases in manufacturing jobs; the city's decline in manufacturing jobs; between 1947 and 1960 was accountable for two-thirds of its job losses.

As the region's center for financial, insurance and business services activity, Boston added almost 14,000 new jobs in these two categories in the period 1947-1960. This sizeable gain was sufficient, however, to compensate only for about a fourth of job losses in other categories, including a 28,000 decline in manufacturing jobs, a 19,000 loss in the trade category and a 5,000 loss in construction employment. By 1960 finance and services provided more jobs in Boston than did manufacturing industry.

On the basis of recent trends, it appears likely that the core will continue to be the region's major employment center. A continuation of 1958-1960 employment trends through 1970 would still leave the core with well over a third of the region's total employment, with the city of Boston supplying between a fifth and a fourth of regional jobs. This implies that Boston and the core will remain a job surplus area, recruiting employees from the suburbs. Thus, there will continue to be a strong need for an effective radial transportation system to carry workers from the suburbs to Boston and the remainder of the core, as well as a large potential market for mass transportation for the journey-to-work of core residents.

D. Highways

Toward the end of the nineteenth century intercity connections had deteriorated to the point where state governments throughout the country were forced to take on road-building responsibilities. Massachusetts was a leader; it was the second state to organize a state roads department.

A bill establishing a State Highway Commission was approved by the legislature in 1893. Before the turn of the century the State Highway Commission developed a plan to connect the major cities with high-quality roads. By 1899 a total of 250 miles of state highways had been completed.

During World War II (1941-1945) state highway construction and planning was decelerated. Less than a month after the conclusion of the war, however, a study was initiated to make recommendations for comprehensive highway improvements in the Greater Boston Area. This study resulted in a report prepared in 1948 entitled The Master Highway Plan. This report proposed a system of radial expressways leading from the city of Boston to suburban communities and leading eventually to other major cities in New England. In addition, two circumferential routes were recommended: (1) an inner loop around the downtown area of Boston, and (2) an outer loop approximately ten miles outside the downtown area. Only a small portion of the Inner Belt has been completed but most of the outer circumferential Route 128 had been completed by 1957.

At the present time there is considerable expressway construction in the Boston region. In addition to the Interstate projects currently underway, federally aided primary and secondary routes in the region are being improved by the state Department of Public Works. The peak highway construction activity in the region is scheduled to continue well into the mid-1960's with no major decrease in the level of spending expected to occur for at least 10 years.

Traffic Characteristics and Volumes

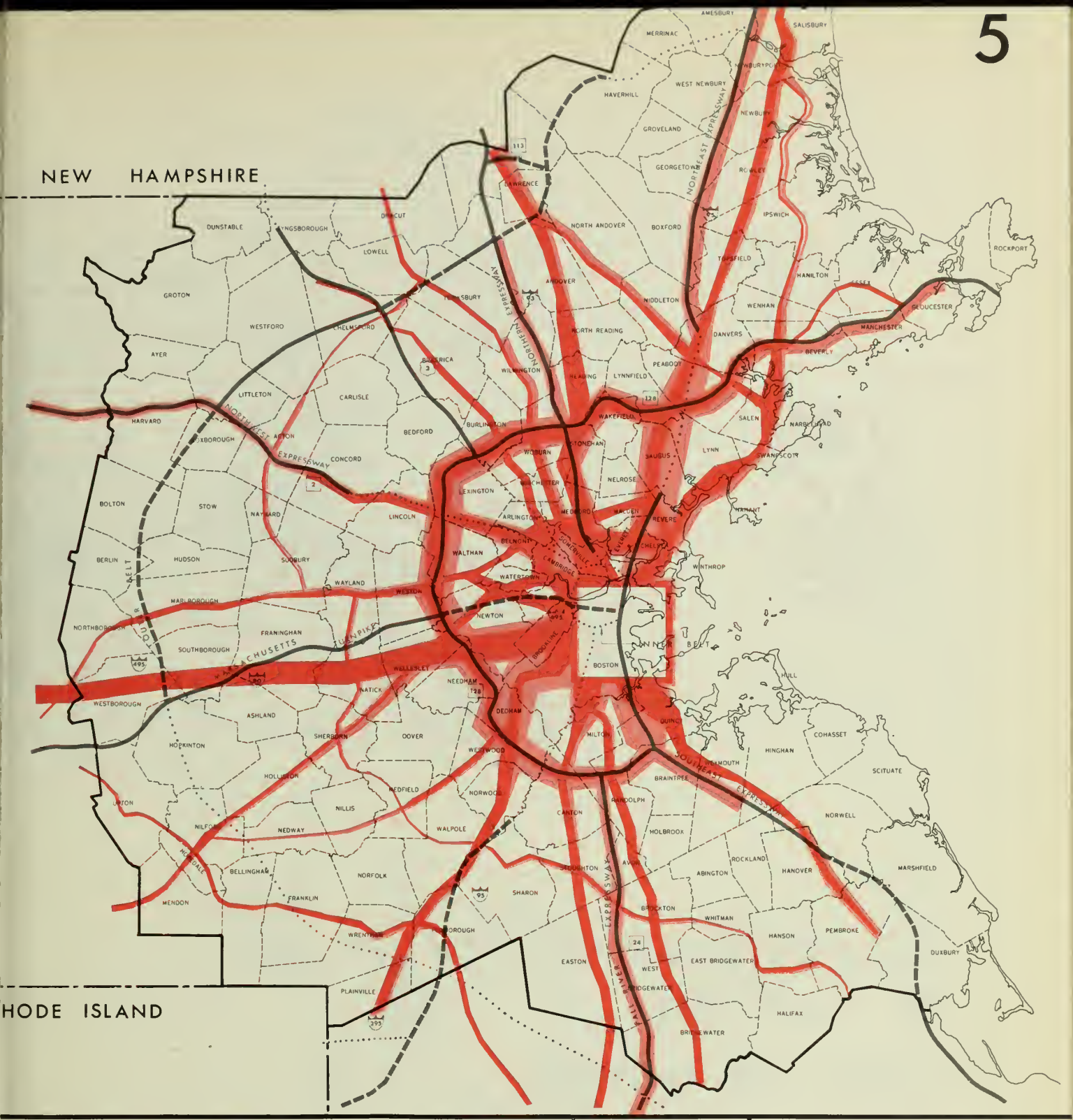
The pattern of traffic volumes encountered in the region is similar to that in other major urban areas. The heaviest volumes are found in the region's hub. The Central Artery which carries the heaviest volume of traffic, at one point carries 110,000 vehicles per day on a six-lane section near High Street. Storrow Drive currently carries 80,000 vehicles per day along the six-lane section east of Massachusetts Avenue, and about 100,000 per day near the Esplanade.

Less than ten years ago traffic volumes of this magnitude were unknown in the Boston area but in recent years construction of high-capacity, limited-access roads has permitted an unprecedented volume of traffic to funnel onto major routes. In 1951 maximum volumes in the region were in the 40,000 to 50,000 vehicles-per-day range. Within a period of 10 years, maximum volumes in the region doubled. This is illustrated in Figure 5 which shows traffic flow, for 1951 and 1960.

Highway improvements in the past have been exclusively aimed at solving highway problems. However, it has become evident that the highway system cannot be isolated and planned as a discreet transportation element, but must be approached in the context of a balance with public transportation. This balance is difficult to achieve because of competition between transportation facilities but methods must be developed to ensure that each mode of transportation in the region is planned, designed, built and utilized to provide the service for which it is best suited. This can only be accomplished through coordinated planning and implementation among the major transportation agencies.

Interchange points between various modes require particular attention. To a degree, the region has already benefited from efforts of this type. For example, the MTA and the railroads have attempted to provide parking areas at convenient points along their routes. The New Haven Railroad's Route 128 station in Canton is an excellent example of such an effort.

It is likely that in the future, additional parking facilities will be provided along existing MTA routes. Moreover, rapid transit extensions require the provision of large parking lots at intermediate stops as well as outlying terminals. Furthermore, although rapid transit agencies will build these parking facilities, access to these lots must be provided by highway agencies. In order for the highways and parking to complement each other there must be a comprehensive development plan for future facilities.



TRAFFIC VOLUME FLOW MAP, 1951 AND 1960

1951

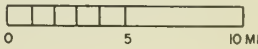
1960

ADT (000)

SOURCE: MASS. D.P.W. ANNUAL FLOW MAPS

NORTH

SQUARE MILES



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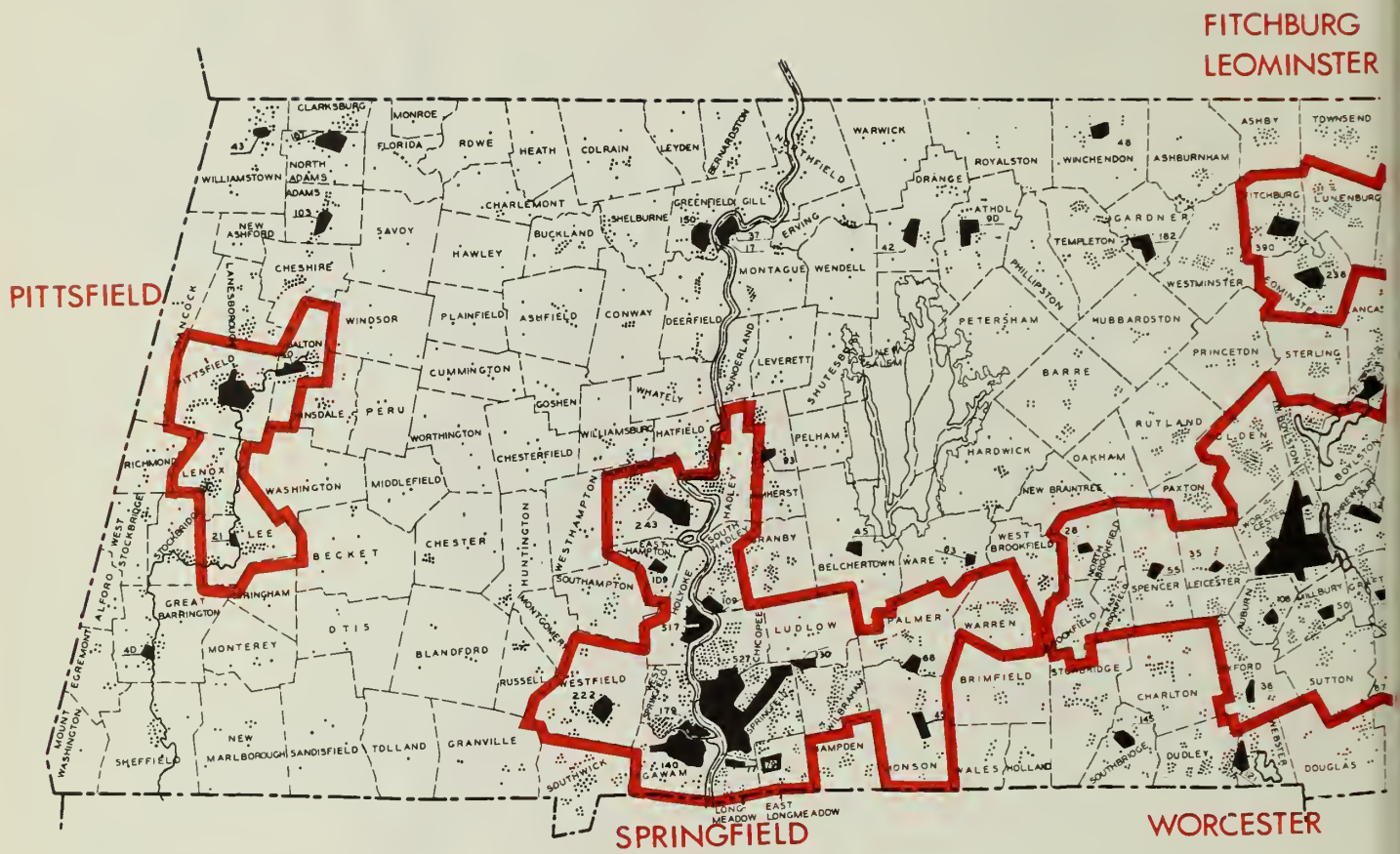
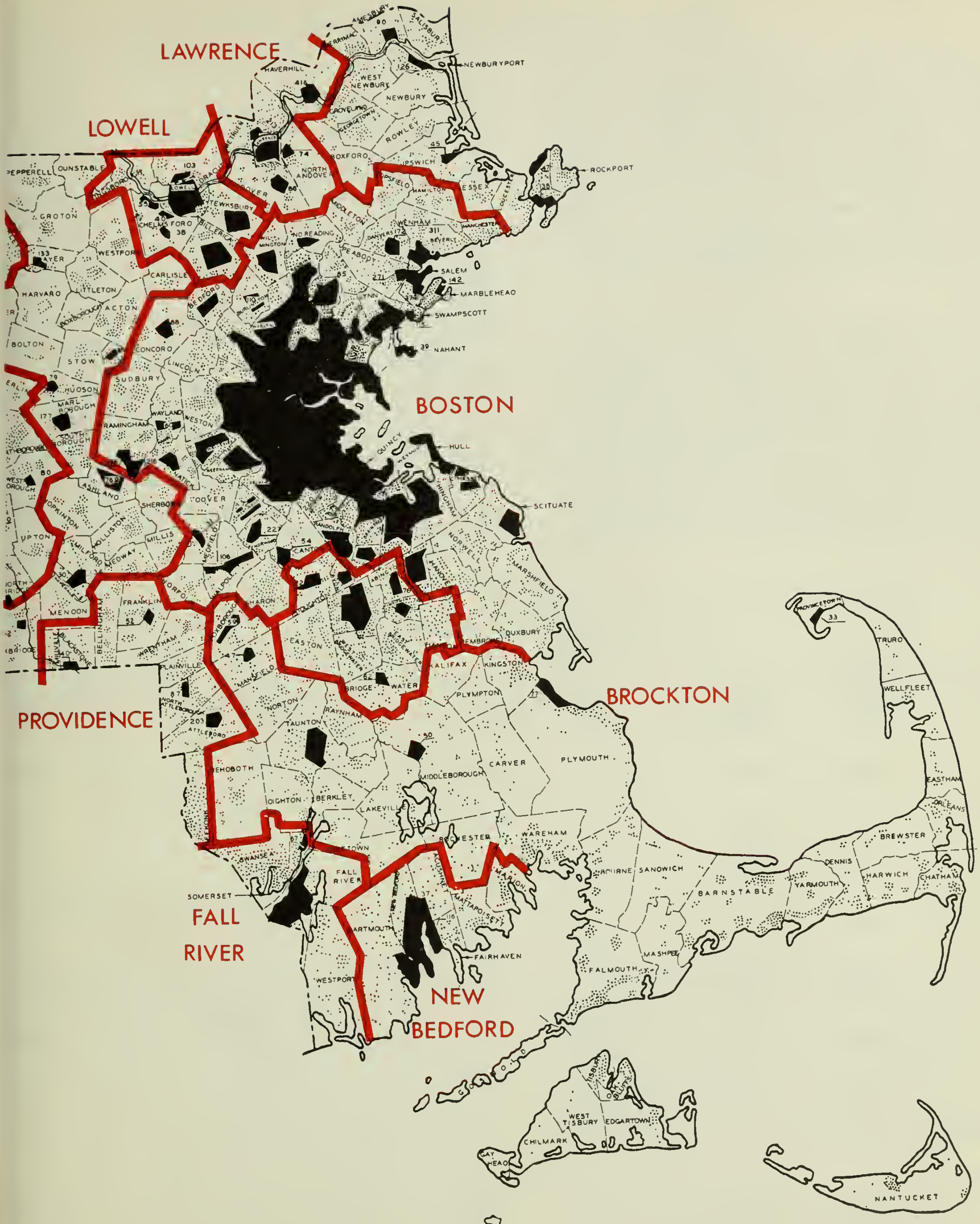


POPULATION DISTRIBUTION FOR THE STATE, AND SMSA's, 1960

SOURCE: U.S. CENSUS


LAWRENCE
LOWELL
BOSTON
BROCKTON
PROVIDENCE
FALL
RIVER
NEW
BEDFORD
NEWBURYPORT
ROCKPORT
MARBLEHEAD
SWAMPSCOTT
NAHANT
HULL
SCITUATE
SOMERSET
FAIRHAVEN
PLYMOUTH
CARVER
WAREHAM
BARNSTABLE
FALMOUTH
MASHPEE
SANDWICH
YARMOUTH
DENNIS
HARWICH
BREWSTER
CHATHAM
ORLEANS
EASTHAM
WELLFLEET
TRURO
PROVINCETOWN
NANTUCKET
EDGARTOWN
WEST TISBURY
CHILMARK
GAY HEAD
GROTON
HARVARD
BOLTON
STOW
ACTON
CONCORD
SUDBURY
TAUNTON
PLYMPTON
DUXBURY
KINGSTON
HALIFAX
MIDDLEBOROUGH
WESTPORT
NEWBURY
ROWLEY
ESSEX
WENHAM
SALEM

E. Other SMSA's in Massachusetts

There are eleven SMSA's in Massachusetts, four of which discussed above, comprise "The Boston Region". Excluding the Boston SMSA, the pattern of urbanization in Massachusetts consists of fairly small evenly distributed clusters of development accented by these numerous SMSA's. This base pattern was established during the 18th Century, primarily because of an agricultural economy, industries using natural water power, and some small amounts of natural resources. Though the population is 85 per cent urban, much of Massachusetts is open land, with considerable portions undevelopable because of excessive grade, subsoil conditions or wetlands.

Massachusetts population growth has been at half the rate of the nation during the past decade. Within the SMSA's central cities have lost population or gained very small absolute amounts. SMSA suburban areas have shown consistent gains near or above the national average. Cities or towns not in SMSA's have had very small, if any, population increases. Well known patterns have followed from these trends: single family housing developments in fringe areas on large lots, highway shopping centers and rising municipal expenditures and tax rates. Central cities, often unimproved for decades, have become obsolete or expensive particularly in the downtown sections to live or work in. Parking problems and traffic congestion further impair central city vitality.

Except for Boston, Massachusetts SMSA's have very narrow and limited economic bases. Generally these centers have an industrial specialty, e.g. shoes and leather, textiles, paper and wood products, or a certain kind of machinery. Consequently, the radical movements of some of these industries after the war have left a number of pockets of surplus labor in the State. Though some areas have replaced industrial losses, irrevocable economic changes have taken place in the communities. An extensive highway system will soon link most the Massachusetts SMSA's with the larger urban regions particularly Boston, the economic hub of the Commonwealth, and reduce the amplitude of business cycles. This will permit a balanced pattern of development, and perhaps, redevelopment of the central cities, physically and socially. Other than Boston commuting the public transportation in these SMSA's has been provided by private bus companies, most of which have been operating on a near marginal basis for several years.

TABLE 6

POPULATION: MASSACHUSETTS' SMSA's 1950–1960

1960			Changes, 1950 – 1960					
			Central City		Suburbs		Total	
Central City	Suburbs	Total	%	Am't	%	Am't	%	Am't
Boston 697,000	1,892,104	2,589,301	–13	–104,247	+18	282,976	+ 7	178,729
Brockton 72,813	76,645	149,458	+16	9,953	+35	19,777	+25	29,730
Fall River 99,942	38,214	138,156	–11	12,021	+51	12,879	1	858
Fitchburg-Leominster 43,021–F 27,929–L	11,536	82,486	+ 1 +16	330 3,854	+41	3,359	+41	+10,743
Lawrence-Haverhill 70,933–L 46,346–H	70,322	187,601	–12 – 2	9,602 934	+29	15,696	+ 3	5,157
Lowell 92,107	65,875	157,982	– 5	5,142	+70	27,137	+16	21,995
New Bedford 102,477	40,699	143,176	– 6	6,712	24	7,904	+ 1	1,192
Pittsburgh 57,879	15,960	73,839	+ 8	4,531	21	2,741	+11	7,272
Providence (Attleboro, Mass.) - - - -	84,790	---	---	---	+24	16,505	---	---
Springfield-Holyoke Chicopee 174,463 52,689 61,553	251,440	478,592	+ 7 – 4 25	12,064 – 1,972 12,342	28	55,006	16	65,098
Worcester 186,587	136,719	323,306	– 8	16,899	+37	37,168	7	20,269

TABLE 7

DETAILED EMPLOYMENT, MASSACHUSETTS SMSA's 1960
(All figures in thousands)

Industry Group Mass. SMSA's (Over 1M total)	Agriculture	Construction	Mfg.	Transport	Ret. Whlse	Fin. Ins.	Busn & Repair	Prsn'l Svcs.	Ent. Mt.	Professional	Pub Admr.	Other
State												
2,000,312 Total	26	100	709	115	347	96	48	54	12	272	95	94
1,277,415 Male	23	96	481	91	221	48	38	31	8	113	72	54
722,897 Female	3	4	228	24	126	48	10	85	3	159	23	40
Boston												
1,023,725 Total	6	51	294	68	191	63	29	47	7	155	57	55
652,620 Male	6	49	204	53	122	31	22	18	5	68	43	31
371,105 Female	1	2	90	15	69	32	7	29	2	86	14	24
Brockton												
55,875 Total	1	3	21	3	10	2	1	2	–	6	2	2
36,447 Male	1	3	14	2	7	1	1	1	–	2	2	1
19,431 Female	–	–	7	1	4	1	–	1	–	4	–	1
Fall River												
56,634 Total	1	2	28	2	9	1	1	2	–	5	3	2
33,766 Male	1	2	15	2	6	1	1	1	–	2	3	1
22,868 Female	–	–	14	–	3	1	–	1	–	3	–	1
Lowrence-Haverhill												
78,176 Total	1	3	38	3	12	2	2	3	–	7	4	3
48,163 Male	1	3	23	3	7	1	2	1	–	3	2	2
30,613 Female	–	–	15	–	5	1	–	2	–	5	1	1
Lowell												
59,619 Total	1	3	25	3	9	2	1	2	–	6	3	3
38,242 Male	1	3	16	3	6	1	1	1	–	3	2	2
21,377 Female	–	–	9	–	3	1	–	1	–	4	1	1
New Bedford												
59,666 Total	2	2	28	3	9	1	1	2	–	5	2	2
34,378 Male	1	2	15	2	6	1	1	1	–	2	2	1
33,288 Female	–	–	13	–	3	1	–	1	–	3	–	1
Springfield Chicopee-Holyoke												
178,856 Total	2	7	71	9	32	9	3	7	1	21	7	7
114,536 Male	1	7	51	7	19	4	3	2	1	8	6	4
64,320 Female	–	–	20	2	13	5	1	4	–	15	1	3
Worcester												
123,831 Total	1	5	51	6	21	6	2	5	1	17	4	4
80,999 Male	1	5	38	5	13	3	2	2	–	7	3	2
42,832 Female	–	–	14	1	8	3	–	3	–	16	1	2

II. History of Mass Transit

Only five major cities in the United States — Boston, New York, Chicago, Philadelphia and San Francisco — are served by commuter railroads. Boston ranks fourth, well behind larger regions in the number of commuter passengers. However, Boston's railroads rank second to New York in total route mileage of track in suburban service. Numerous main line and branch routes are a legacy from the nineteenth century when the economic prospects of the Boston Region stimulated railroad over-expansion. As a result, Boston has almost twice as many miles of line as Philadelphia but only half as many rail commuters. Instead of being concentrated along a few major axes of travel, Boston railroad passengers spread out in a diffuse pattern along numerous travel corridors.

A brief review of historical highlights in the development of public transportation in the Boston regions helps in understanding the present public transportation system. Boston was a leader not only in the introduction of new means of transportation, but also in adopting technical innovations more extensively than other areas. A century of complex and rapid technological, social, and economic changes can be summarized in terms of a few principal factors.

A. Piecemeal Growth

Boston's present mass transit system is based to a large extent on the speculative ventures of individual entrepreneurs five to six decades ago. It did not grow out of a comprehensive, rational plan and was by no means based on

prudent economic evaluation. Early financial successes led to over-development, including duplication of routes, poor connections between lines and construction of trackage in areas with inadequate market potential.

Since 1930 the bus and automobile have had a great impact in the transit market. The interurban portion of the street car system in the outer areas has been entirely replaced by bus routes, and even in the inner area a considerable number of bus routes have supplanted streetcar service.

B. Trend from Private to Public Ownership

Rail transit operations were transferred from private to public ownership when transit became unprofitable. Private owners financed the first stages of development when companies were assured a lucrative near-monopoly of urban travel. In the belief that extensions into new territory rather than equipment improvement was the key to higher revenue, transit companies attempted to maximize returns by pushing rail lines into thinly populated territory while allocating funds for improvements to equipment and facilities reluctantly and only after considerable public prodding.

By 1918 the widespread dependence on mass transit and the obvious shortcomings in service and equipment led to increasing public concern over the transit system. When private owners pleaded inability to improve operations because the system had become unprofitable, government began to exercise increasing control over private management. A public Control Act passed in 1918 was designed to assure continuance of transit service to the 14 cities and towns served by the Boston Elevated Company. Any deficit was to be assumed by the 14 cities and towns of the District in proportion to their shares of passenger traffic.

It was hoped that this was only a temporary measure but, because of continuing financial difficulties, in 1930 public control was extended by a referendum. A further legislative act in that year created the Boston Metropolitan Transit District, comprising the same 14 cities and towns, with a governing Metropolitan Transit Council. The Boston Metropolitan Transit District was given the right to issue bonds, and the Council was given power to adjust fares. It was clear by this time that a return to profitable private operation of rail transit service was impossible primarily because the public had become accustomed to a relatively high level of service at low fares.

Inauguration of public control and ownership of rail transit coincided with a fundamental change in the nation's transportation habits. The private automobile, with its flexibility and convenience, effectively challenged the supremacy of mass transportation and caused a continuing decline in patronage reversed only in the war period. The Act of 194 established public ownership in the form of the Metropolita Transit Authority. However, subsequent experience prove that public ownership was not in itself the remedy for th basic weakness of the transit system: its inability to cove the cost of service in the face of steadily declinin patronage.

C. Effects on Regional Structure and Growth

Each phase of mass transportation innovation and exten sion left enduring effects on the region. Horsecars an omnibuses provided the basis for the first commutin suburbs for the wealthy. Low fare electric railways per mitted people with lower incomes to live at some distanc from their place of employment. Rapid transit stimulate high density residential, commercial, and industrial develop ment in the region's core. Self-powered buses extended mas transportation to low density suburban areas.

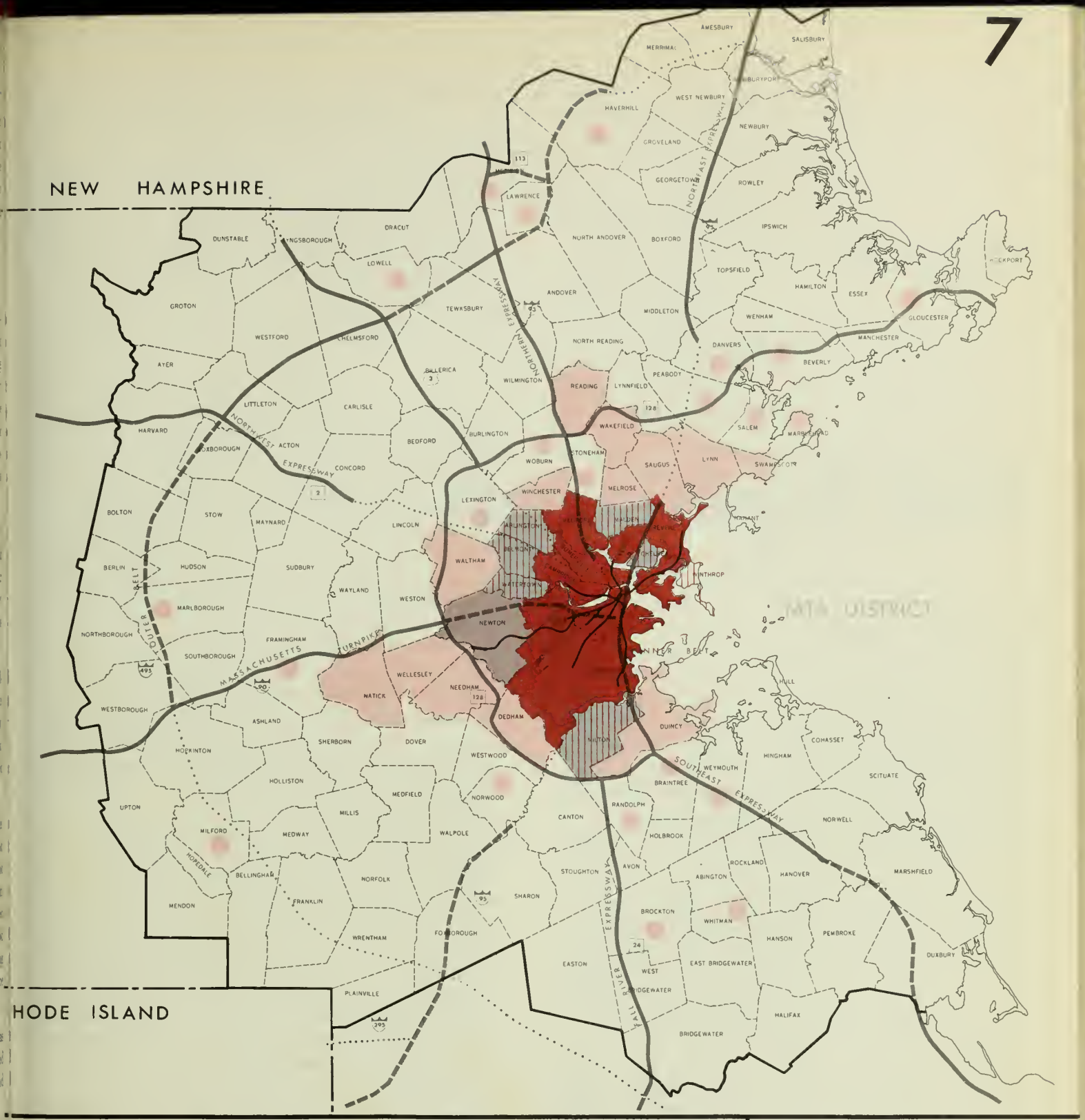
The transit system helped provide the foundations fo large scale suburban growth. Whereas the earlier railroa expansion helped to establish small urban centers nea suburban stations, the construction of the electric stree railway provided the basis for the first wave of mas suburbanization.

Electric street railroads both fostered and required ad jacent high density development since the cost involved ir construction limited geographical coverage. Consequently high density tenement districts were built within easy walk ing distance of transit lines and became closely associate with public transportation.

Contacts increased between rural and urban centers as well as between individual urban settlements with the spread of low cost mass transit. Transit permitted industry and large offices requiring substantial numbers of female workers to expand their labor market; growth of labor-oriented activities was accelerated at points which enjoyed good public transportation access. Inter-change between outlying satellite communities and Boston also increased, laying the groundwork for growing regional interdependence.

Boston, the largest of the region's urban centers, was located at the focal point of the electric railway system, and concentration and expansion of activities was greatest and most rapid in the city particularly in its downtown area.

The pattern of regional land use was shaped decisively by the developing rail network, although other factors such as demographic characteristics and economic patterns and trends also influenced urban growth. Some degree of suburbanization would have taken place in any case to accommodate a growing population, but it is reasonable to assume that the extent of urban spread prior to the mid-1920's would have been far more limited in the absence of an efficient mass transit system.



MASS TRANSIT WORK TRIPS, 1959

WORKERS USING PUBLIC TRANSPORTATION

- UNDER 10 %
- 10 – 19 %
- 20 – 29 %
- 30 – 39 %
- NO FIGURES AVAILABLE FOR THIS AREA

SOURCE: U. S. CENSUS, 1960

NORTH

2560 ACRES = 1 SQUARE MILES

0 5 10 MILES

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Chapter Three

Rail Experiments

I. Negotiation of Carrier Contracts

As the study activities of the Legislative Recess Committee and the MTC were being completed and their joint report was being formulated in December, 1961, exploratory discussions were held with the management of the Boston and Maine, New Haven, and New York Central Railroads. The object of these discussions was to determine whether the railroads would be willing to participate in what was to become the Mass Transportation Commission Demonstration Project. Participation by the Boston and Maine Railroad required the railroad management to defer filing petitions for total discontinuance of all railroad commuter passenger service into Boston, petitions which then were in the final stages of preparation and were tentatively scheduled for formal filing in April 1962.

All three railroad managements indicated their willingness to cooperate and participate in the program. There followed negotiations between the technical staffs of the railroads and the staff and consultants to the MTC. The objective of these technical negotiations was to determine what pattern of service could be obtained by maximum utilization of existing equipment and an estimate of the maximum impact of fare reductions of various magnitude.

The agreements negotiated at the policy and technical levels were then incorporated in the application by the Commission to the Office of Transportation, the U.S. Housing and Home Finance Agency (HHFA) for a demonstration grant.

Subsequent to the formal submission to the HHFA, negotiation in respect to a final agreement with the New York Central Railroad proved inconclusive and the New York Central Railroad did not participate directly in the experimental portion of the program.

It was agreed that the Commission would pay the railroads less than the Interstate Commerce Commission (ICC) allocated costs for the total level of service required by contract, but more than the probable combination of incremental cash costs from the increase in service and passenger revenue reductions from the reduction in fares. A determination of the true incremental cash costs was one of the objectives of the Demonstration Project. Such a determination could only be made subsequent to the completion of the experimental phase of the project and hence could not serve as a firm basis for determining contractual compensation terms in the carrier contracts.

In the case of the New Haven Railroad, the technical staffs were in full agreement that the ICC allocated losses from the level of service to be contractually required during the experimental period could not be offset by any reasonable possible combination of increased revenue and Commission payments.

In the case of the B&M, the technical staffs again were in agreement that the cost of service contractually required of the railroad probably could not be offset by the possible increase in passenger revenue resulting from increases in

passenger volume and the contractual Commission payments to the railroad during the experimental period.

As a safety measure however, the MTC contract with the B&M provided that if the operating ratio for the B&M passenger service was reduced to 110 according to the ICC allocation formulae, (including the MTC payments to the railroad in determining the ratio) for the experimental period, all revenues above the 110 level would be credited to a reduction of the Commission's obligations to the railroad.

Contracts with both railroads provided the possibility for amendment on the completion of six months of actual experimental service.

II. Boston and Maine Railroad

The B&M participated in an experiment in three phases. The first of these lasted for seven months (January-July 1963); the second, for five months (August-December 1963); and the third, for three months (January-March 1964). A description of the varying service and fare patterns in each phase and the results of each of the experiments are outlined below.

In 1962 the B&M carried some 5.3 million passengers annually to and from Boston on a route structure that fans out from the city in a northerly and westerly direction, as shown in Figure 8. To the northeast, the B&M *Eastern Route* serves Lynn, Salem, and Beverly (18 miles). The route then splits, with a line to Rockport, thirty-five miles from Boston, and a line to Newburyport (37 miles) which extends on to Portsmouth, New Hampshire.

To the north, the B&M *Reading Line* (12 miles) serves six suburban stations in three towns. Also to the north, the *Western Route*, which diverges from the New Hampshire Route at Wilmington (15 miles), serves Lawrence (25 miles) and Haverhill (33 miles) and extends to New Hampshire and Maine. The *New Hampshire (Lowell) Route* serves Lowell (25 miles) and also extends to points in New Hampshire. The *Woburn Line* diverges from the New Hampshire Route at Winchester (8 miles) to Woburn (10 miles).

The Fitchburg Division serves the western segment of the B&M route structure. Passenger service operates on the *Fitchburg Line* to the industrial center of Fitchburg, which is fifty miles from Boston, and the line extends for freight service only to the Connecticut River Line and to points in New York State. Passenger service is also provided on two branches of the Fitchburg Division to Bedford and Hudson.

A. Purpose

There was a five-fold purpose in providing for the changes in service and fares in the railroad portions of the Demonstration Project.

1. To test the ability of service increases to halt and reverse the declining trend in passenger use of rail facilities.

2. To test the comparative importance of service and fare changes in increasing passenger volume.

3. To determine precisely the incremental costs and revenues arising from changes in service and fares.

4. To determine the avoidable cash loss attributable to continuation of railroad commutation service.

5. To construct a model for the evaluation of the costs of alternative service levels and configurations.

The B&M provided the opportunity to test these matters on a railroad with completely modern and relatively efficient passenger equipment.

The management of the B&M deserves credit for its public spirited decision to temporarily postpone discontinuance of its passenger service. This was a secondary benefit arising from B&M participation in the Demonstration Project, although not one of the objectives or justification of the Project. This deferral allowed the Commonwealth to decide on the basis of the data to be developed by the Demonstration Project whether the Commonwealth should subsequently act to avoid this discontinuance after the completion of the experiments.

B. Description of Experiments

1. Phase One (January-July 1963)

a. Service

During the first phase, overall service on the B&M (weekday and weekend) was increased by 77 per cent. Weekday service was expanded by 92 per cent, with peak-hour service increasing by 82 per cent and off-peak service, by 96 per cent. This required 386 trains per day, an increase of 182 per day over the 1962 level of service.

Four lines — Eastern, Reading, Lowell, and Fitchburg — had at least a 90 per cent increase in total service. Service on two lines — Bedford and Hudson — remained unchanged, so that the effect of the commuter fare reduction could be more accurately measured.

b. Fare

The fare changes were equally dramatic. Both one-way and twenty-ride commutation tickets were reduced by varying amounts — from as little as 12 per cent for a one-way ticket between Boston and Melrose Highlands to as much

TABLE 8

B&M SERVICE INCREASES – FIRST PHASE

Line	Total Service	Weekday Service	Weekday Peak	Weekday Off-Peak
Eastern	96%	120%	81%	143%
Reading	92	111	117	109
Western	35	46	58	44
Lowell	107	118	113	119
Woburn	53	63	86	58
Fitchburg	90	95	68	112
Bedford Hudson	No Change in Schedule			
Suburban Total	77%	92%	82%	96%

Note: The percentage increases are based on the total number of trains operating over a portion or the whole of a particular line. The service at any given station on a line was not necessarily increased by the same per cent.

Source: B&M timetables #81 and #1.

TABLE 9

B&M FARE REDUCTIONS – FIRST PHASE

Line	Ticket Type	
	Twenty Ride [1]	One-Way [2]
Eastern	29%	36%
Reading	22	27
Western	32	37
Lowell	31	30
Woburn	21	30
Fitchburg	30	39
Bedford	24	42
Hudson	30	24

1. 30-day limit on 20-ride ticket book
2. One-year limit on one-way ticket

Source: B&M Tariffs

as 72 per cent for the same kind of ticket between Boston and Fitchburg.

The fare reductions which averaged 28 per cent overall, as shown by line in Table 9, are the average reductions at the major stations on each line, weighted by the number of passengers using each of these stations.

2. Phase Two (August-December 1963)

In the second B&M phase, service was maintained at approximately the same level as during the first phase, but there were substantial changes in the fare structure. The price of a twenty-ride ticket was raised to about the same level as it had been prior to the first phase, a new lower price one-way, off-peak fare was introduced on all lines except the Reading and Woburn. On these, the unlimited use one-way fare was raised. On all other lines the first phase one-way fare became the unlimited use rate.

The new fare structure developed by the MTC was intended to test the price elasticity of commuter fares and to fit fares to cost and demand factors. The increased service and across-the-board fare reductions on the B&M produced substantial passenger increases in the first seven months of operation. The levelling off in passenger and revenue volume as the experiment progressed, however, indicated that the impact of the first phase of the program had already been fully tested.

The new fare structure tested the willingness of peak period commuters to pay fares close to their pre-demonstration levels for the improved quality of service provided in the experiment. At the same time, it determined if lower fares in the off-peak periods, coupled with the continued improved service, does attract additional passengers at times when automobile travel is easiest.

The heaviest and most concentrated demand for commuter rail service occurs in the rush hours. The basic costs of the entire service are incurred in meeting this demand. Off-peak service constitutes a by-product which involves relatively little additional expense. Thus, these fare changes presented a price structure that were calculated to reduce the cash loss to the railroad of commuter rail transportation.

The tariff revisions, developed with the assistance of Systems Analysis and Research Corporation, achieved the additional objective of restoring consistency to the patchwork pattern of fares resulting from increases in point to point fares on a piecemeal basis over many years. Differentials in the cost of 20-ride commuter tickets under the revised schedule were determined solely by the length of haul.

The rationale for determining the level of commuter fares was based upon the ownership costs of the self-propelled Budd Rail Diesel Cars (RDC) and a mileage cost which varies with the distance between stations. The carrying charges on a typical RDC run over $15,000 per year (1962 average was $14,700, which included no return on original equity and nothing for eight cars then fully paid for.) One hundred cars carry approximately 10,000 passengers in the peak period. Thus, 100 passengers require one car. Each passenger's share of the annual carrying charge is $150 or 60c per work day. Therefore, a constant of 30c per one way trip is established as a base for the regular commutation rate structure, in order that one inbound and one outbound passenger will pay 1/100th of the cost of ownership of the equipment. To this is added a rate per mile declining from 1.9c for the shorter distance to 1.7c for the greater. This takes into account the significant impact of terminal costs on short hauls and the greater demand elasticity evidenced by the greater response to the demonstration project at greater distances, and follows this formula:

Miles	Rate per Ride	Cost of 20-ride Ticket — $6.00 plus
1-20	1.9c per mile	38c per mile
21-40	1.8c per mile	36c per mile
41 or more	1.7c per mile	34c per mile

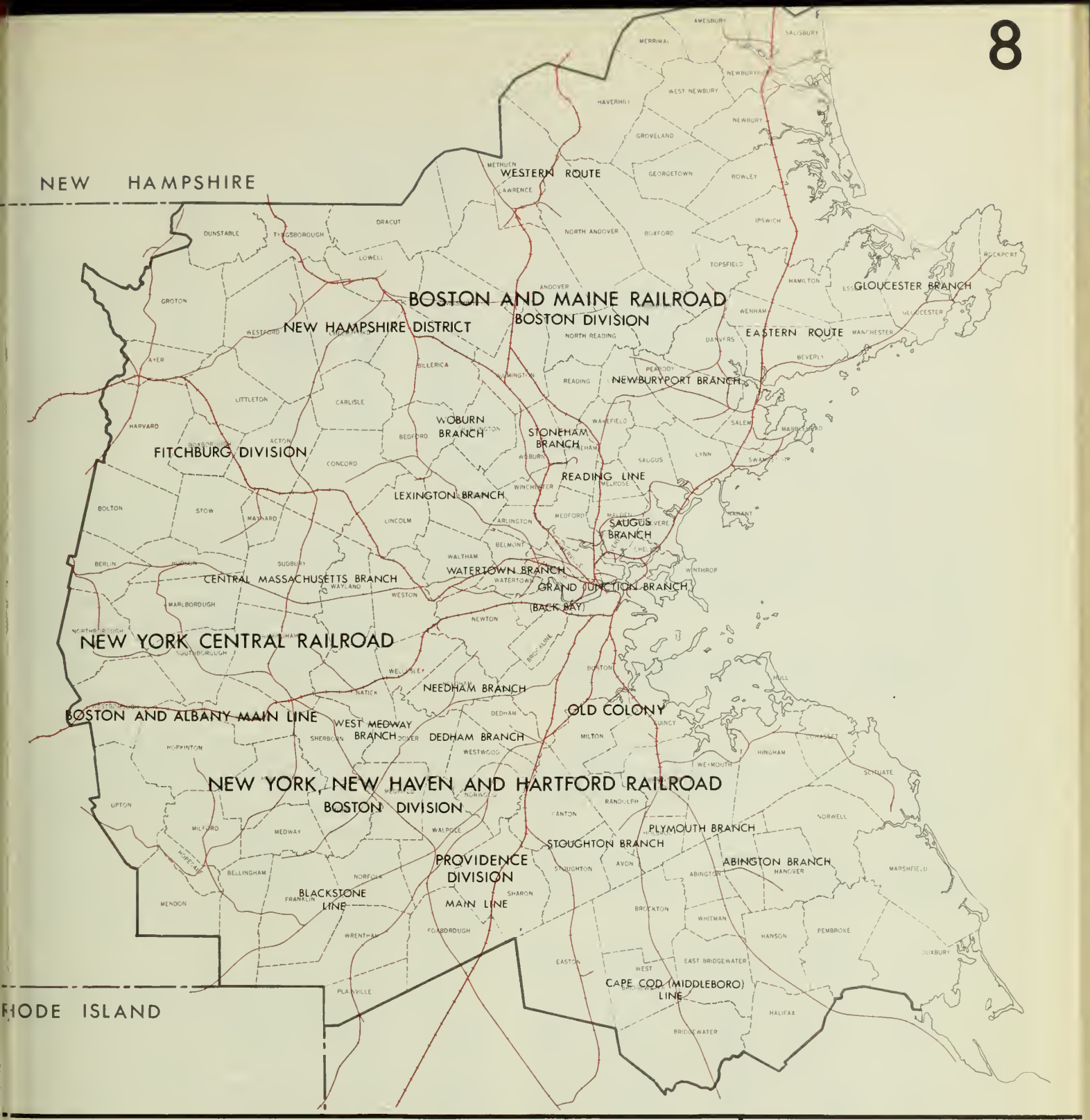
One-way off-peak fares were set up on a zone basis and are generally below the cost per ride of a 20-ride ticket with a minimum of 50c covering up to 20 miles, 60c for 21 to 25 miles, 65c for 26 - 30 miles, 75c for 31 - 40 miles and 85c for 41 - 50 miles. For the longest runs this meant a saving of 26 per cent on the multiple ticket rate. These fares were applicable on any train arriving in Boston after 9:30 A.M. or any outbound train except between 4:30 and 6:30 P.M. and on all trains on Saturdays, Sundays and holidays.

Peak one-way fares were raised to 55c in the zone where the off-peak fare is 50c. The remainder of the peak one-way fares remained the same as the one-way fares during the first seven months of the experiment. This fare is higher in every case than any commutation rate or the new off-peak fare. Table 10 illustrates the rates between Boston and some of the major B&M stations.

3. Phase Three (January-March 1964)

The first two phases of the B&M experiment tested the mix of increased service and reduced fares, and of increased commutation fares and low-off-peak fares with increased service remaining as a constant.

Phase three of the B&M experiment was designed to accomplish four additional objectives:



RAILROAD COMPANIES AND OPERATING DIVISIONS, 1960

SOURCE: RAILROAD ROUTE MAPS AND TIMETABLES

NORTH

2560 ACRES
SQUARE MILES

0 5 10 MILES

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TABLE 10

BOSTON & MAINE COMMUTER FARES AT SELECTED STATIONS

Between Boston and	Miles	Off-Peak One Way Fares (A) Prior to Experiment	(B) Phase 1	(C) Phases 2 & 3	Peak One Way Fares (A) Prior to Experiment	(B) Phase 1	(C) Phases 2 & 3	20 Ride Commutation Rates (A) Prior to Experiment	(B) Phase 1	(C) Phases 2 & 3
Melrose	6.8	$ .57	$ .50	$ .50	$ .57	$ .50	$ .55	$ .436	$ .349	$ .435
Winchester	7.8	.74	.50	.50	.74	.50	.55	.454	.361	.453
Woburn	9.7	.74	.50	.50	.74	.60	.60	.492	.385	.490
Lynn	11.6	.86	.50	.50	.86	.50	.65	.534	.406	.530
Reading	12.0	.86	.50	.50	.86	.50	.65	.534	.406	.530
Wilmington	15.2	1.12	.85	.50	1.12	.85	.85	.618	.436	.605
Salem	16.3	1.12	.85	.50	1.12	.85	.85	.637	.444	.625
Concord	20.1	1.40	.85	.60	1.40	.85	.85	.710	.485	.680
Andover	23.1	1.49	.85	.60	1.49	.85	.85	.742	.506	.733
Lowell	25.4	1.64	1.10	.65	1.64	1.10	1.10	.791	.536	.770
Lowrence	26.4	1.64	1.10	.65	1.64	1.10	1.10	.791	.536	.788
Haverhill	33.3	1.77	1.10	.75	1.77	1.10	1.10	.844	.576	.844**
Newburyport	37.3	2.06	1.10	.75	2.06	1.10	1.10	.964	.610	.964**
Fitchburg	49.6	2.87	1.65	.85	2.87	1.65	1.65	1.180	.773	1.150

* 20-ride fares are computed on the basis of rounding fractional miles to the next higher whole mile.
** 20-ride fare as per formula was cut back to pre-demonstration level to avoid a fare increase.

Source: Boston & Maine Railroad

a. To test the effect of increased frequency in carefully selected areas upon commutation and off-peak traffic.

b. To test the effect of schedules tailored to the demand generated in the first two phases of the demonstration program.

c. To test a schedule which attempts to accomplish much higher utilization of men and equipment, thereby reducing the overall cost per passenger mile.

d. To provide an opportunity to test the tentative conclusions of the first two phases of the Boston & Maine demonstration project and to put to practical use the data analysis carried out by the Commission's staff and consultants.

The newly designed schedules for phase three were put into operation on January 7, 1964 and continued in effect through March 21, 1964.

Because of a State law defining a regularly scheduled train as one which operates for more than 12 consecutive months the Railroad requested that it be allowed to operate its 1962 level of service for a three-day period between phase two and phase three so that the trains added at the beginning of the demonstration program could not be legally considered permanent trains. The Attorney General of Massachusetts issued an opinion concurring in this interpretation.

The operation of a reduced frequency for one business day in January did not materially affect patronage levels. The small effect apparently was due in a large part to the highly successful public information efforts by the MTC and the Railroad.

After careful study of the passenger increases by station and by line and also of train operations the MTC, in cooperation with the B&M, designed a tailored service for phase three as follows:

First: The peak frequency of service on the Eastern route was increased from a 15-minute headway to a new 10-minute headway and the afternoon outbound off-peak service was increased from a 30-minute headway to a 15-minute headway. Throughout the course of the experiment the Eastern route has shown significant gains in passenger travel and the new service was designed to test the ability of very frequent service to attract additional passengers and, in addition, to provide an opportunity to better utilize existing manpower and equipment by increasing the flow of seats per hour.

Second: The peak hour frequency on the Fitchburg division was increased from a 30-minute headway to a 15-minute headway between South Acton and Boston. The off-peak frequency was substantially increased during the remainder of the day from a 90-minute or longer headway to hourly service with a one-half hourly headway in the afternoon, both as far as South Acton. This route, like the Eastern, had shown considerable growth during the first two phases of the experiment; and, consequently, it was desirable to find out the impact of greater frequency.

Third: The peak hour frequency on the New Hampshire and Western routes was kept at approximately the same level as the first two phases, while off-peak service was specifically tailored to the volume and growth exhibited during 1963. The terminal points for the routes involved, Woburn, Lowell and Haverhill, had their frequency reduced from 60 minutes to 90 minutes. By scheduling these trains at proper intervals the large volume stations, which are common to the various routes, continue to receive 60 to 30 minute service as provided during 1963. By rescheduling service on the New Hampshire and Western routes a substantial saving in train miles was possible.

Fourth: The peak hour service on the Reading line remained the same in Phase Three. The off-peak frequency was also kept the same with the exception of between 10:00 A.M. and 2:00 P.M., when it was changed from one-half hourly to hourly consistent with the demand exhibited in 1963.

TABLE 11

BOSTON AND MAINE RAILROAD HEADCOUNTS 1st PHASE
JANUARY – JULY 1962 vs. 1963)

Monday–Friday Travel Only, Inbound and Outbound

Route Figures Include Inbound and Outbound	January			February			March			April		
	1962	1963	% Increase	1962	1963	% Increase	1962	1963	% Increase	1962	1963	% Increase
Eastern Route												
Peak	75,594	86,321	14.2	77,139	91,403	18.5	83,827	99,746	19.0	81,837	99,033	21.0
Off-Peak	19,757	36,999	87.3	21,096	42,667	102.3	20,623	44,282	114.7	20,718	43,787	111.3
Total	95,351	123,320	29.3	98,235	134,070	36.5	104,450	144,028	37.9	102,555	142,820	39.3
Reading Line												
Peak	101,091	112,267	11.2	101,364	113,794	12.3	110,083	125,335	13.6	109,024	125,439	15.1
Off-Peak	27,572	35,719	29.5	31,821	39,875	25.3	31,993	42,891	34.1	32,300	42,242	30.8
Total	128,663	147,986	15.0	133,185	153,669	15.4	142,076	168,226	18.4	141,324	167,681	18.7
Western Route												
Peak	34,426	35,110	2.0	35,456	37,297	5.2	39,717	39,862	0.7	38,850	40,049	3.1
Off-Peak	15,714	18,199	15.8	15,449	21,037	36.2	16,736	21,189	26.6	16,883	21,491	27.3
Total	50,140	53,309	6.3	50,905	58,334	14.6	56,453	61,051	8.2	55,733	61,540	10.4
N.H. Div.–Lowell-Waburn												
Peak	73,784	87,220	18.2	75,156	89,170	18.6	84,357	98,176	16.4	82,866	99,064	19.5
Off-Peak	28,039	38,114	35.9	32,143	43,636	35.8	30,389	44,123	45.2	33,149	46,264	39.6
Total	101,823	125,334	23.1	107,299	132,806	23.9	114,746	142,299	24.0	116,015	145,328	25.3
Fitchburg Division												
Peak	26,525	34,972	31.8	26,987	37,212	37.9	30,385	40,290	32.6	30,277	39,401	30.4
Off-Peak	5,925	10,966	85.1	6,769	14,270	110.8	7,084	13,899	96.2	7,682	14,242	85.4
Total	32,450	45,938	46.1	33,756	51,482	52.8	37,469	54,189	44.6	37,909	53,643	41.5
All Lines												
Peak	311,420	355,890	14.3	316,104	368,876	17.0	348,369	403,409	15.8	342,804	402,986	17.6
Off-Peak	97,007	139,997	44.3	106,568	161,485	51.5	106,825	166,384	55.6	110,732	168,026	51.7
Total	408,427	495,887	21.4	422,672	530,361	25.5	455,194	569,793	25.2	453,536	571,012	25.9

Route Figures Include Inbound and Outbound	May			June			July		
	1962	1963	% Increase	1962	1963	% Increase	1962	1963	% Increase
Eastern Route									
Peak	83,526	101,871	22.0	72,427	90,393	24.8	79,893	97,537	22.1
Off-Peak	21,148	42,353	100.3	18,729	37,503	100.2	23,483	45,755	94.8
Total	104,674	144,224	37.8	91,156	127,896	40.3	103,376	143,292	38.6
Reading Line									
Peak	111,676	128,643	15.2	99,829	111,522	11.7	101,119	114,389	13.1
Off-Peak	30,985	40,625	31.1	24,359	33,505	37.5	26,202	37,488	43.1
Total	142,661	169,268	18.7	124,188	145,027	16.8	127,321	151,877	19.3
Western Route									
Peak	37,198	40,915	8.1	29,262	32,069	9.6	30,466	33,290	9.3
Off-Peak	17,834	22,981	28.9	14,994	19,905	32.8	15,176	22,306	47.0
Total	55,032	63,896	16.1	44,256	51,974	17.4	45,642	55,596	21.8
N.H. Div.–Lowell-Waburn									
Peak	81,438	97,917	20.2	72,354	85,265	17.8	73,425	86,926	18.4
Off-Peak	32,032	45,134	40.9	27,101	39,434	45.4	29,850	43,337	45.2
Total	113,470	143,051	26.1	99,455	124,699	25.4	103,275	130,263	26.1
Fitchburg Division									
Peak	30,711	40,752	32.7	26,086	34,881	33.7	27,456	36,018	31.2
Off-Peak	7,460	14,318	91.9	6,136	12,310	100.6	6,434	12,716	97.6
Total	38,171	55,070	44.3	32,222	47,191	46.5	33,890	48,734	43.8
All Lines									
Peak	344,549	410,098	19.0	299,958	354,130	18.1	312,359	368,160	17.9
Off-Peak	109,459	165,411	51.1	91,319	142,657	56.2	101,145	161,602	59.8
Total	454,008	575,509	26.8	391,277	496,787	27.0	413,504	529,762	28.1

Source: Trainmen's Head Counts: Boston and Maine Railroad

C. Results of Experiments

1. Phase One

a. System Totals

The effect of the increased service and fares was reflected dramatically in the first month (January 1963) of the experiment. Patronage increased by 30 per cent over the prior month. In absolute terms, the B&M attracted 5,500 more passengers on the average weekday, and 2,600 more passengers over the weekend than in December 1962.

Table 11 shows the growth in ridership as measured by trainmen's headcounts. A count of the number of people is made on each train as it enters or leaves Boston every day. This number is not as accurate as the record of revenue passengers obtained from the train audits which are based on tickets lifted (See Table 16); however, as it is a daily record and can be easily subdivided into peak and off-peak period it is a very useful trend statistic.

It was apparent, however, as the experiment progressed, that the major impact had been registered almost at the outset. Ridership increased somewhat in February and March, and then slid off with the advent of good weather. On a comparative basis, however, it was apparent that the B&M was holding the patronage that had been gained. Each succeeding month showed an increasing gain over the corresponding month in 1962. By the close of Phase One at the end of July, the B&M had carried 800,000 more passengers than in the preceding year which represented a substantial 27 per cent improvement in patronage.

Passenger revenue earned during the phase was $21,000 greater than in the preceding year, thus offsetting the loss inherent in the fare reduction. The revenue improvement made only a minor contribution, however, to the costs of the added service, which approximated $700,000, during the period covered by phase one.

b. Line Totals

There were wide variations in the effect of the experiment on the various lines. On the Eastern Route total patronage measured by headcounts increased by 37 per cent over 1962. Ridership did not decline as on other lines during the spring and summer months. The absence of the seasonal drop in riders is attributable to the summer traffic to the resort areas on Cape Ann.

Passenger traffic on the heavily travelled Reading Line was the least responsive to fare reductions and increased service, except for the Western Route which represented a special situation. The percentage gain in ridership over the seven month period on the Reading was a subaverage 18 per cent.

The Western and New Hampshire (Lowell) Routes should be considered as an entity in gauging the results of the experiment because of the shift in Wilmington passengers. In 1962 Wilmington was a station stop on the Western Route. For the first four months of 1963, however, Wilmington became a stop on the New Hampshire Route. This shift accounted for the lack of improvement on the Western Route and the substantial gains on the Lowell Line.

The Woburn Line has the same short-line characteristics as the Reading, and similarly showed only a moderate gain in passengers. Woburn, however, did not have as great an increase in service as the Reading Line, nor were the fare reductions as significant.

The relatively less heavily travelled Fitchburg Line showed the largest percentage gains in riders during the experiment. The Bedford and Hudson branches had above-average fare reductions but no increase in frequency of service. The change in patronage on these lines was negligible as shown in Table 12.

c. Passenger Characteristics

The pattern of passenger travel was analyzed to determine the time at which riders travelled, their origins and destinations, and the types of tickets used.

In total, 63 per cent of all passengers rode on trains inbound to Boston during weekday morning peak hours, and outbound trains during the afternoon peak hours. Another 29 per cent rode during the weekday off-peak periods. and the remaining 8 per cent, on weekends. When it is considered that off-peak travel includes the "reverse flow" traffic in peak hours and riders in the pre- and post-peak hours (particularly outbound school children between 3:30 p.m. and 4:30 p.m.), it is clear that the B&M is essentially a commuter railroad. (Table 14.)

TABLE 12

BOSTON AND MAINE RAILROAD
Monthly Headcount Summary of Bedford-Hudson Branches
Monday – Friday Totals
Inbound and Outbound

MONTH	1962	1963	% Change
Jonuory	12,406	13,022	+5.0
February	11,651	12,609	+8.2
Morch	13,705	14,098	+2.9
April	13,305	13,572	+2.0
May	13,353	13,430	+0.6
June	11,962	11,923	–0.3
July	13,571	13,177	–2.9
August	11,750	11,244	–4.3
September	12,201	11,798	–3.3
October	15,476	14,762	–4.6
November	11,897	11,221	–5.7
December	13,164	12,646	–3.9

	1962	1963	1964	% over '63	% over '62
Januory	12,406	13,022	13,214	+1.5	+6.5
Februory	11,651	12,609	12,699	+0.7	+9.0
*March	9,851	10,004	9,564	–4.4	–2.9

Saurce: Boston ond Maine Trainmen's Headcounts

*Experiment concluded March 21, 1964

TOTAL REVENUE PASSENGERS IN AND OUT OF BOSTON

SOURCE: RR RECORDS

TABLE 13

DISTRIBUTION OF B&M PASSENGERS BY STATIONS
Outbound Average Weekday Revenue Passengers

LINE EASTERN	May 1962	Jan. 1963	Feb. 1963	April 1963	July 1963	Sept. 1963	Dec. 1963	Jan. 1964	Feb. 1964	Mar. 1964	April 1964	May 1964
Lynn	142	300	423	302	281	258	335	325	291	319	204	198
Swampscott	313	419	410	400	403	409	457	439	402	425	345	330
Salem	299	461	465	450	428	446	531	541	515	574	422	379
Beverly	449	562	626	500	492	579	643	659	625	660	552	531
N. Beverly	47	67	82	72	67	67	90	66	79	82	76	81
Hamilton & Wenham	143	182	125	170	189	189	189	225	204	211	178	173
Ipswich	87	126	127	131	131	161	182	203	206	201	139	125
Rowley	21	23	23	27	25	26	23	20	23	24	16	14
Newburyport	93	191	196	190	187	213	266	278	258	268	163	111
Montserrat	81	108	99	100	96	96	105	111	100	109	92	92
Prides	14	14	15	13	19	19	21	18	17	14	15	12
Beverly Farms	82	92	79	82	84	89	93	97	90	91	78	98
Manchester	119	159	147	155	219	218	194	185	180	188	164	159
W. Gloucester	9	80	5	9	16	16	21	19	18	19	17	16
Gloucester	162	303	267	300	360	343	344	385	353	370	272	252
Rockport	75	126	108	132	217	183	163	145	146	148	123	122
TOTAL	2136	3213	3197	2933	3214	3312	3657	3761	3507	3703	2856	2693

READING	May 1962	Jan. 1963	Feb. 1963	April 1963	July 1963	Sept. 1963	Dec. 1963	Jan. 1964	Feb. 1964	Mar. 1964	April 1964	May 1964
Malden	39	28	24	N.A.	N.A.	29	29	32	25	29	24	17
Wyoming	48	387	448	"	"	398	540	560	645	253	194	255
Melrose	808	583	570	"	"	423	609	587	443	911	797	784
Melrose Hlds.	461	555	639	"	"	407	608	582	582	647	530	513
Greenwood	150	128	122	"	"	117	141	98	139	139	124	121
Wakefield	745	901	892	"	"	859	1018	1014	963	974	864	859
Reading	831	898	959	"	"	993	1101	1111	1054	1097	995	928
TOTAL	3082	3480	3654			3166	4046	3984	3851	4050	3528	3477

NEW HAMPSHIRE	May 1962	Feb. 1963	Mar. 1963	Sept. 1963	Dec. 1963	Jan. 1964	Feb. 1964	Mar. 1964	April 1964	May 1964
W. Medford	68	79	82	65	80	75	83	83	81	77
Wedgemere & Winchester	768	941	970	973	1029	1025	992	1069	848	764
Cross St.	81	99	120	108	114	104	103	99	107	106
Woburn	503	645	668	643	753	727	683	684	631	618
Win. Hlds.	6	7	8	5	N.A.	5	2	4	6	5
Wilmington	311	342	346	325	301	401	375	388	340	321
Silver Lake	1	1	0	0	0	0	0	0	0	0
E. Billerico	5	2	6	6	5	3	7	7	1	0
N. Billerico	46	85	84	85	78	87	85	89	60	60
Lowell	493	625	660	637	672	639	765	809	625	570
TOTAL	2282	2826	2944	2847	3032	3066	3095	3232	2699	2521
WESTERN										
Salem St.	12	N.A.	18	22	23	18	11	9	5	10
Bollordvole	10	13	11	8	11	10	12	9	11	10
Andover	232	290	273	267	308	290	265	305	221	238
Shawsheen	35	40	47	50	70	56	47	46	30	28
Lawrence	364	605	596	513	642	613	609	624	524	500
N. Andover	39	40	44	44	61	47	59	50	41	51
Bradford Haverhill	249	315	309	303	406	356	360	368	310	289
TOTAL	941	1303	1298	1207	1521	1390	1363	1411	1142	1126

FITCHBURG	May 1962	Jan. 1963	Mar. 1963	April 1963	Sept. 1963	Dec. 1963	Jan. 1964	Feb. 1964	Mar. 1964	April 1964	May 1964
Clemotis & Beaver Brook	26	21	25	24	25	22	22	23	24	25	34
Wolthom	96	167	230	194	153	171	193	193	225	134	134
Riverview	1	1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Roberts	8	15	25	18	27	59	65	88	84	40	41
Kendal Green	45	82	69	18	34	53	47	40	54	35	43
Hastings	10	12	22	73	62	57	71	68	70	54	57
Silver Hill	10	4	N.A.	N.A.	N.A.	15	N.A.	N.A.	N.A.	N.A.	5
Lincoln	120	130	142	129	150	158	161	159	151	133	131
Concord	190	237	328	263	275	315	321	312	368	256	250
W. Concord	50	68	74	69	66	88	92	96	116	78	76
So. Acton	60	74	98	84	145	112	120	109	117	76	66
W. Acton	49	99	67	68	44	73	75	76	75	76	72
Littleton	29	35	34	38	43	50	48	46	49	40	44
Ayer	50	74	77	92	106	128	108	106	107	86	64
Shirley	7	5	N.A.	N.A.	N.A.	9	17	17	20	18	18
N. Leominster	21	25	37	41	38	39	40	36	43	32	30
Fitchburg	31	51	94	53	60	80	86	67	80	46	40
TOTAL	803	1190	1232	1164	1228	1429	1466	1436	1583	1129	1105

N.A. Not Available
Source: B&M Train Audits

The analysis of passenger origins and destinations showed that 95 per cent of all passengers use North Station either as the beginning or end of their trip. Only 5 per cent of the riders travel between two stations located outside of Boston. This analysis also showed large concentrations of traffic in relatively few stations — 19 stations with two thousand or more passengers each per week — accounted for 78 per cent of the total riders in and out of Boston. The remaining 58 stations accounted for only 22 per cent of the riders.

During the first phase, 72 per cent of the passengers used multiple-ride tickets. This was a decline from the 80 per cent level of the prior year. The increase in the use of one-way and round-trip tickets is readily attributable to the substantial increase in off-peak service during the experiment. As might be expected, the multiple-ride tickets are used primarily during peak hours. In fact they account for 86 per cent of all tickets used at those times.

d. Revenue Analysis

Revenues earned during the seven months of the experiment exceeded those in the same period of the previous year by $20,000 (See Chapter Four, Table 30). Thus the gain in patronage offset the effect of fare reductions. Through June, however, there was a cumulative deficit in weekday revenues. This was offset however by Saturday revenues which were greater in 1963, as shown on Table 29, Chapter Three. On balance, the experiment from January through June showed a slight year-to-year improvement of about $4,000. In July the trend above the break-even point continued, and an additional increase of approximately $16,000 was recorded for that month. The improvement in the revenue picture is largely attributable to year-to-year comparisons and not to increases in riders during the month. The July 1962 figures reflect a continuation of the long-term decline in patronage. The 1963 results reflect a lesser seasonal dip. Thus, the year-to-year comparisons produce a favorable showing for the month.

Comparative revenue results by line follow the same pattern as the passenger results. (This matter is included in the Supplement Two, prepared by McKinsey & Co., Inc.)

2. Phase Two

The second phase on the B&M started August 1, 1963, and extended through the end of the year. Changes in fare structure initiated with the second phase consisted of restoring fares for multiple-ride tickets to substantially pre-experiment levels, and reducing one-way fares during off-peak hours.

a. System Totals

Patronage was not adversely affected by the peak-hour fare increases. In fact, travel during the peak hours actually increased by 3,500 passengers per month over the level of the first experiment. Moreover, the further reduction in off-peak and weekend fares increased that type of patronage by some 33,000, or 16 per cent, per month over the first experiment.

TABLE 14

PASSENGERS BY TIME OF TRAVEL
(Thousands)

	Average Day		
	First Phase	Third Phase	Increase
Weekday peak	365.4	385.4	20.0
Weekday off-peak and weekend	216.6	285.7	69.1
Total	582.0	671.1	89.1

Note: Portion of first phase comparable to third phase period.

Source: B&M Train Audits.

Comparisons with the prior year were even more favorable during the second phase than were those during the initial phase of the B&M experiment. Revenue passengers carried increased by 790,000 or 37.5 per cent, over those carried in the like five-month period in 1962. This increase averaged approximately 158,000 per month as compared to a 114,000 monthly increase in the Phase One, Table 15 shows the changes in ridership in peak and off-peak for the second phase based on trainmen's headcount.

The passenger revenue earned during the second phase was $284,000 greater (20 per cent) than for the same period in the prior year, as shown in Table 31, Chapter Four. The increased revenues were more than adequate to cover the fare reductions. However, they contributed only about 57 per cent of the incremental service costs, which approximated $500,000 during the course of the experiment.

The overall results for the second phase showed a 36 per cent year-to-year increase in revenue passengers on weekdays and a 54 per cent increase on weekends. These year-to-year increases are greater than during the first phase, but this is attributable primarily to the secular decline in 1962 rather than any dramatic increases in 1963 as the patronage during the second phase was only 7 per cent higher than in the first phase.

b. Line Totals

The weekday results by line are more revealing. The response to the new fare structure in the second phase was uneven by comparison with the results of phase one. The change in passengers carried per month varied from an increase of 18 per cent on the Western Line to a decrease of 2 per cent on the Bedford and Hudson lines.

Table 15

BOSTON AND MAINE RAILROAD

Headcounts – Second Phase
August – December
1962 vs. 1963

Monday–Friday Travel Only, Inbound and Outbound

Route Figures Include Inbound and Outbound	August			September			October			November			December		
	1962	1963	% Increase	1962	1963	% Increase	1962	1963	% Increase	1962	1963	% Increase	1962	1963	% Increase
Eastern Route															
Peak	79327	97973	23.5	75972	90905	19.7	85526	107053	25.2	70722	85518	20.9	78499	97391	24.1
Off-Peak	22730	48488	112.9	20080	42641	112.4	21956	52119	137.4	17892	41138	129.0	22633	52426	131.6
Total	102107	146461	43.4	96052	133546	39.0	107482	159172	48.1	88614	126656	42.9	101132	149817	48.2
Reading Line															
Peak	97539	113860	16.7	98649	113112	14.7	110265	133993	21.5	93678	106567	13.8	104568	122350	17.0
Off-Peak	26592	38282	44.0	27798	35009	25.9	32397	45129	39.3	27901	37282	33.6	37194	52965	42.4
Total	124131	152142	22.6	126447	148121	17.1	142662	179122	25.6	121579	143849	18.3	141762	175315	23.7
Western Route															
Peak	29532	33079	12.0	32093	36027	12.3	40301	45959	14.1	32750	39620	21.0	35159	43666	24.2
Off-Peak	15367	21985	43.1	15408	22777	47.8	17683	27236	54.0	16681	23410	40.3	18423	28149	52.8
Total	44899	55064	22.6	47501	58804	23.8	57984	73195	26.2	49431	63030	27.5	53582	71815	34.0
N.H. Dist.-Lowell-Woburn															
Peak	70456	87705	24.5	71745	89801	25.2	83313	107283	28.8	70228	82879	18.0	77464	93918	21.2
Off-Peak	30161	44093	46.2	27845	41270	48.2	31603	51225	62.1	28614	41660	45.6	36480	56928	56.1
Total	100617	131798	31.0	99590	131071	31.6	114916	158508	37.9	98842	124539	26.0	113944	150846	32.4
Fitchburg Division															
Peak	26586	35525	33.6	26773	37115	38.6	29443	44219	50.2	25134	35779	42.4	28338	41691	47.1
Off-Peak	5865	13497	130.1	5961	13050	118.9	7020	18473	163.1	6443	14194	120.3	7842	19543	149.2
Total	32451	49022	51.1	32734	50165	53.3	36463	62692	71.9	31577	49973	58.3	36180	61234	69.2
All Lines															
Peak	303440	368142	21.3	305232	366960	20.2	348848	438507	25.7	292512	350363	19.8	324028	399016	23.1
Off-Peak	100765	166345	65.1	97092	154747	59.4	110659	194182	75.5	97531	157684	61.7	122572	210011	71.3
Total	404205	534487	32.2	402324	521707	29.7	459507	632689	37.7	390043	508047	30.3	446600	609027	36.4

Source: Trainmens' Head Counts. Boston and Maine Railroad

The increase on the Western Line was due to the shift in the Wilmington passengers from Lowell to Western trains and to higher than average improvements in off-peak patronage. The increases on the Fitchburg (12 per cent) and Eastern (8 per cent) are probably most indicative of the impact of the fare changes. The Reading and Woburn lines, which had no off-peak fare reductions, showed only 4 per cent increases. On the Lowell line the small increase (3 per cent) was attributable in part to the high volume that line was carrying during the January to April period due to service changes with respect to Wilmington passengers as discussed above. The Bedford and Hudson lines, which have no off-peak service, showed a decline. Their commuter patronage, however, was not materially affected by the fare increase since the decline was minimal.

A summary of ridership based on headcounts for the first two phases is shown in Table 17.

TABLE 16

B&M AVERAGE REVENUE PASSENGER PER MONTH,
First and Second Phase (Thousands)

Line	First Phase	Second Phase	Increase/ (Decrease)
Eastern	149.7	157.3	5%
Reading	155.1	157.2	1
Western	60.0	67.0	12
Lowell	60.2	60.3	–
Woburn	63.5	64.3	1
Fitchburg	56.1	61.0	9
Bedford-Hudson	12.7	12.0	(6)
Total	557.3	579.1	4%

Source: Boston and Maine Railroad Train Audits

c. Revenue Analysis

Revenues earned in the second phase averaged $340,000 per month, an increase of $57,000 over the monthly average during the same months of 1962. Although these results represent a substantial improvement over the first phase, the revenue increase did not absorb the costs of the added service by a substantial margin.

The revenue results by line showed some variations. On weekdays, all lines except the Western, and Bedford and Hudson had revenue increases. Apparently the increase in patronage on the Western Line was not sufficient to cover the off-peak fare reductions. Bedford and Hudson's very slight revenue decrease is in part a result of the decline in

Table 17

BOSTON AND MAINE RAILROAD

Headcount
Summary-First and Second Phase
By Route,
Peak and Off-Peak
January through December
1962 vs. 1963

Monday through Friday Travel only,
Inbound and Outbound

	1962	1963	Increase in Passengers	% Increase
Eastern Route				
Peak	944,289	1,145,802	201,513	21.3
Off-Peak	250,895	530,158	279,263	111.3
Total	1,195,184	1,675,960	480,776	40.2
Reading Line				
Peak	1,238,177	1,420,613	182,436	14.7
Off-Peak	357,114	481,012	123,898	34.7
Total	1,595,291	1,901,625	306,334	19.2
Western Route				
Peak	415,210	456,943	41,733	10.1
Off-Peak	196,348	270,665	74,317	37.8
Total	611,558	727,608	116,050	19.0
N.H. Dist. Lowell-Woburn				
Peak	916,586	1,105,324	188,738	20.6
Off-Peak	367,406	535,218	167,812	45.7
Total	1,283,992	1,640,542	356,550	27.8
Fitchburg Division				
Peak	334,651	457,865	123,204	36.8
Off-Peak	80,621	171,478	90,857	112.7
Total	415,272	629,333	214,061	15.5
All Lines				
Peak	2,848,913	4,586,537	737,624	19.2
Off-Peak	1,252,384	1,988,531	736,147	58.8
Total	4,101,297	6,575,068	1,473,771	28.9

Source: Trainmen's Head Counts: Boston and Maine Railroad

patronage, and in part due to the fact that peak-hour fares during the second phase were a few cents per ride less than in 1962. On weekend traffic only the Reading, Woburn, and Fitchburg lines had revenue increases. On the Reading and Woburn lines during the second phase, there were no further fare reductions for off-peak travel. The Fitchburg Line had a sufficiently large increase to offset the effect of the reductions. On none of the other lines was the increase in weekend patronage sufficient to cover the reduced fares.

3. Phase Three

The third phase of the B&M experiment started January 7, 1964 and extended through March 21, 1964. The fare structure remained the same as in the prior phase, but there were selective changes in service.

a. System Totals

Patronage in peak and off-peak hours continued to increase over the level of the second phase.

It should be recognized that 10 per cent of the increase is attributable to the fact the third phase included only the winter months during which the heaviest travel occurs. Nevertheless, it is apparent that peak-hour patronage improved despite the fare increase instituted in the second phase. Furthermore, the off-peak travel apparently was unaffected by the service changes during the third phase.

In the third phase, comparisons with the pre-experimental period were more favorable than either of the earlier phases. Revenue passengers increased by 504,000, or 44 per cent, over those carried in the same period in 1962. This increase averaged approximately 205,000 per month compared with a 158,000 monthly increase in the second phase.

Passenger revenue earned during the third phase was $221,000 greater (29 per cent) than for the same period in the prior year, as shown in Table 32. This increase averaged $90,000 per month which was more than enough to offset the increased cost of the experiment which, during the third phase, amounted to $89,000.

b. Line Totals

The overall results for third phase showed a 41 per cent increase on weekdays and an 85 per cent increase on weekends. The results by line illustrate the response to the service changes made in the third phase. The Eastern and Fitchburg Lines, on which there were peak-hour service increases, showed year-to-year improvements in weekday travel of 59 per cent and 74 per cent, respectively — the greatest for these two lines during the experiment. The results on the lines for which there were weekday, off-peak service decreases were inconclusive. On the Reading Line, the year-to-year increase was higher than either of the earlier phases. The results on the Western and Lowell Lines taken together indicate increases about as great as during the second phase and somewhat greater than during the first. The Woburn Line had increases that were less than those of the second phase and equal to that of the first phase.

The dramatic improvement in weekend results was reflected on all lines, particularly on the three longer ones — Eastern, Lowell and Fitchburg.

c. Revenue Analysis

Revenues earned in the third phase averaged $395,000 per month. The increase over the pre-experimental level was sufficient to cover the incremental cost of the experiment, but made only a small contribution to the level of passenger deficit that existed prior to the experiment.

The overall increase in weekday revenue amounted to 31 per cent (Table 32). The results by line, however, continued to show wide variation as they had in earlier phases.

Table 18

BOSTON AND MAINE RAILROAD

Headcount – Third Phase
January 1, – March 21,*
1962, 1963, 1964
Monday-Friday, Inbound and Outbound Headcounts

Route Figures Include Inbound and Outbound	January 1962	January 1963	January 1964	% Change 1964) over (1964 1963)	% Change 1964) over (1964 (1962	February 1962	February 1963	February 1964	% Change 1964) over (1964 1963)	% Change 1964) over (1964 (1962	March 1962	March 1963	March 1964	% Change 1964) over (1964 1963)	% Change 1964) over (1964 (1962
Eastern Route															
Peak	87597	99382	105052	+ 5.7	+ 19.9	77139	91403	94572	+ 3.5	+ 22.0	60160	71841	71055	– 1.1	+ 18.1
Off-Peak	22933	42380	51740	+22.1	+125.6	21096	42667	52092	+22.1	+146.9	14941	30626	38816	+26.7	+159.8
Total	110530	141762	156792	+10.6	+ 41.9	98235	134070	146664	+ 9.4	+ 49.3	75101	102457	109871	+ 7.2	+ 46.3
Reading Line															
Peak	117225	129892	135997	+ 4.7	+ 16.1	101364	113794	122228	+ 7.3	+ 20.6	78836	90126	91643	+ 1.7	+ 16.2
Off-Peak	32459	41178	46103	+12.0	+ 42.0	31821	39875	44241	+10.9	+ 39.0	22796	30404	32778	+ 7.8	+ 43.8
Total	149684	171070	182100	+ 6.4	+ 21.7	133185	153669	166469	+ 8.3	+ 25.0	101632	120530	124421	+ 3.2	+ 22.4
Western Route															
Peak	40111	40588	52021	+28.2	+ 29.7	35456	37297	48815	+30.9	+ 37.7	28504	28086	36037	+28.3	+ 26.4
Off-Peak	18430	20842	29982	+43.9	+ 62.7	15449	21037	28881	+37.3	+ 86.9	12643	14950	20325	+36.0	+ 60.8
Total	58541	61430	82003**	+33.5	+ 40.1	50905	58334	77696**	+33.2	+ 52.6	41147	43036	56362	+31.0	+ 37.0
N.H. Dist.-Lowell-Woburn															
Peak	85530	100282	98743	– 1.5	+ 15.4	75156	89170	89575	+ 0.5	+ 19.2	60532	71043	67882	– 4.4	+ 12.1
Off-Peak	32582	44179	47682	+ 7.9	+ 46.3	32143	43636	45623	+ 4.8	+ 41.9	21232	31246	31674	+ 1.4	+ 49.2
Total	118112	144461	146425**	+ 1.4	+ 24.0	107299	132806	135198**	+ 1.8	+ 26.0	81764	102289	99556	– 2.7	+ 21.8
Fitchburg Division															
Peak	30890	40368	41652	+ 3.2	+ 34.8	26987	37212	40242	+ 8.2	+ 49.1	21704	28763	29603	+ 2.9	+ 36.4
Off-Peak	6872	12556	21749	+73.2	+216.5	6769	14270	23325	+63.4	+244.6	4973	9840	17081	+73.6	+243.5
Total	37762	52924	63401	+19.8	+ 67.9	33756	51482	63567	+23.5	+ 88.3	26677	38603	46684	+20.9	+ 75.0
All Lines															
Peak	361353	410512	433465	+ 5.6	+ 20.0	316102	368876	395432	+ 7.2	+ 25.1	249736	289859	296220	+ 2.2	+ 18.6
Off-Peak	113276	161135	197256	+22.4	+ 74.1	107278	161485	194162	+20.2	+ 81.0	76585	117066	140674	+20.2	+ 83.7
Total	474629	571647	630721	+10.3	+ 32.9	423380	530361	589594	+11.2	+ 39.3	326321	405925	436894	+ 7.4	+ 33.9

** Shift in Train Schedules in Lowell-Woburn to Haverhill Passenger Trains – 1963-1964
* Experiment Concluded on March 21, 1964
Source: Trainmen's Head Counts. Boston and Maine Railroad

Table 19

BOSTON AND MAINE RAILROAD

Headcount – Third Phase/Summary
January-February-March 21
1962, 1963, 1964
Based on Monday-Friday, Inbound and Outbound Head Counts

Route Figures Include Inbound and Outbound	1962	1963	1964	% Change 1964) 1963)	% Change (1964 over (1962
Eastern Route					
Peak	224896	262626	270679	3.1	20.4
Off-Peak	58970	115673	142648	23.3	141.9
Total	283866	378299	413327	9.3	45.6
Reading Line					
Peak	297425	333812	349868	4.8	17.6
Off-Peak	87076	111457	123122	10.5	41.4
Total	384501	445269	472990	6.2	23.0
**Western Route (incl. N.H. Dist.-Lowell-Woburn)					
Peak	325289	366466	373073	7.3	20.8
Off-Peak	132479	175890	204167	16.1	54.1
Total	457768	542356	597240	10.1	30.5
Fitchburg					
Peak	79581	106343	111497	4.8	40.1
Off-Peak	18614	36666	62155	69.5	237.5
Total	98195	143009	173652	21.4	76.8
All Lines					
Peak	927191	106247	1125117	5.2	21.3
Off-Peak	297139	439686	532092	21.0	79.1
Total	1224330	1508933	1657209	9.8	35.4

** Western Route and N.H. Dist.-Lowell-Woburn combined Divisions Combined to show shift in train schedules from January thraugh March 21, only.

The Reading, Woburn, and Bedford and Hudson Lines had revenue increases about equal to the passenger increases. This reflects the fact these lines are primarily used by commuters and there was no off-peak fare reduction to attract additional occasional riders. The Eastern, Western, Lowell and Fitchburgh had smaller revenue increases because of the effect of off-peak fare reductions.

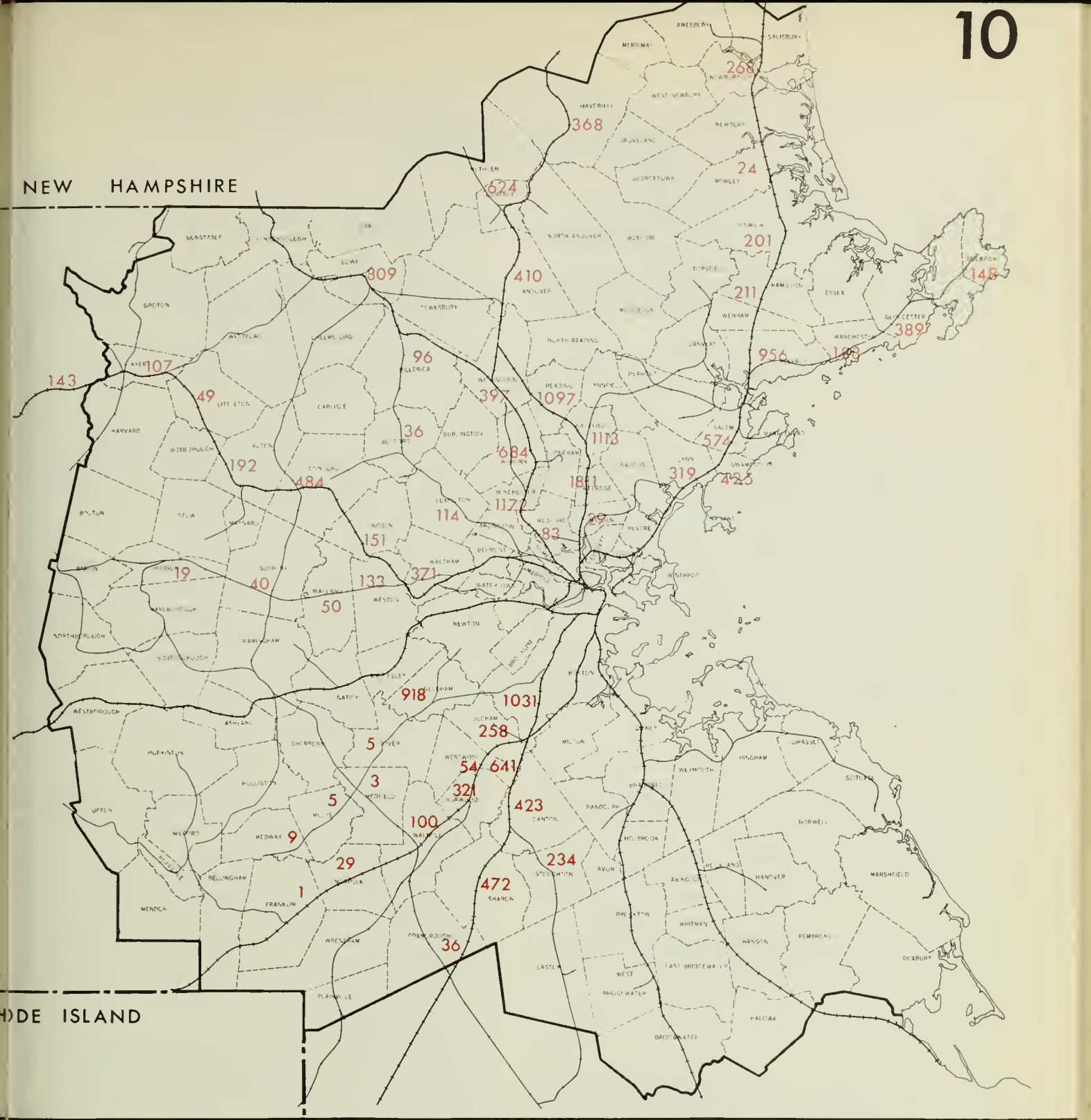
On weekends the overall revenue increase amounted to 17 per cent. All lines had revenue increases, except the Western, but each was smaller than the corresponding increase in patronage — reflecting the impact of the off-peak fare reductions.

III. New Haven Railroad

A. Purpose of New Haven Experiment

The New Haven Railroad offered the opportunity to test the results of changes in service and fares on a railroad with a mixture of old and new passenger equipment, in contrast to the modern RDC B&M equipment. The magnitude of service and fare change in the New Haven experiment was deliberately varied from those of the B&M experiments in order to develop a wider range of experimentation.

The fundamental objectives of all the railroad experiments were substantially advanced by the New Haven experiments.



ISTRIBUTION OF AVERAGE WEEKDAY INBOUND
AILROAD PASSENGERS, PEAK AND OFF PEAK,
Y CITY/ TOWN OF BOARDING

34 BOSTON & MAINE

41 NEW HAVEN

NORTH

2560 ACRES
1 SQUARE MILES

0 5 10 MILES

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

These objectives were:

1. To test the ability of service increases to halt and reverse the declining trend in passenger use of rail facilities.
2. To test the comparative importance of service and fare changes in increasing passenger volume.
3. To determine precisely the incremental costs and revenues arising from changes in service and fares.
4. To determine the avoidable cash loss attributable to continuation of railroad commutation service.
5. To construct a model for the evaluation of the costs of alternative service levels and configurations.

B. Description of Experiments

1. Phase One

a. Service

The first phase of the New Haven experiment began March 10, 1963 and lasted through September 7, 1963. Off-peak service on the Boston and Providence Line was increased by the addition of eight round trips each weekday and five on Saturdays. On the line to Needham Heights, off-peak service was increased by the addition of five round trips each weekday and four on Saturdays. No changes were made on the remaining lines or in the peak hour service. The total increases in East End commuter service amounted to 42 per cent as compared to the 77 per cent increase on the B&M. All trains added by the New Haven consisted of one Budd car, operated in off-peak hours.

b. Fare

The fare reduction on all of the East End lines averaged about 10 per cent. The price of multiple-ride tickets were reduced by 9 to 13 per cent. Round-trip tickets were reduced by varying amounts up to 20 per cent and one-way fares were unchanged. These fare changes on the Providence Line did not apply to any station south of Attleboro since the Demonstration Program was applicable only within Massachusetts. In essence the New Haven experiment provided a peak-hour fare reduction with no change in service, and an off-peak increase in service with little or no reduction in fares.

2. Phase Two

a. Service

The second experiment ran from September 8, 1963 through March 7, 1964. Changes were made reflecting the experience gained in the first six months. The off-peak service on the Boston to Providence line was retained at the same level as in the first experiment. Service on the Needham Line was reduced to pre-experiment levels.

b. Fare

The round-trip and commutation fares were raised to pre-experiment levels on all lines. In addition, the cost of one-way fares for off-peak travel on the Boston to Providence Line was reduced and put on a zone basis similar to that used on the Boston and Maine. In essence the second phase applied only to the Boston to Providence Line and results for the remaining lines were used only for comparative purposes.

C. Results of Experiment

1. Phase One

The first phase of the New Haven experiment produced many of the same results experienced in the B&M experiment, though in different degrees. Where service was increased and fares reduced, an increase in patronage was recorded. In those areas where fares were reduced but service was unchanged, the patronage showed little or no increase.

The overall increase in patronage provided sufficient additional revenue to offset the fare reductions but did not represent any significant contribution to the incremental cost of the experiment.

a. Line Totals

Several of the stations on the Providence Line are served by trains from two or even three other lines. The assignment of patronage and revenues from these stations to any one line would be misleading since patronage would not necessarily be lost if service on that line were discontinued. Therefore the results of the experiment are presented by passenger service area.

During the first phase of the New Haven experiment, Massachusetts intrastate revenue patronage increased 110,000 passengers or 10 per cent (Table 23). Substantially all of this increase, 97,000 passengers, was obtained from the two passenger service areas on the Providence Line which had an overall increase of 23 per cent.

The greatest increase in numbers of passengers and percentage was registered in the Route 128, Attleboro service area of the Providence Line. The stations in this area are all located between 12 and 32 miles from Boston. The Mount Hope-Readville service area which is only six to ten miles from the city provided the next best results, both in percentage and absolute terms.

The balance of the passenger service areas showed virtually no response to fare reductions, paralleling the experimental results on the Bedford and Hudson Lines of the B&M. Table 20 shows New Haven ridership by months based on headcounts.

b. Passenger Characteristics

The pattern of patronage was examined in the same manner as for the B&M to determine the time people travelled, their origins and destinations, and the kind of ticket they used.

The New Haven local East End patronage was somewhat more highly concentrated in peak hours than was true on

Table 20

NEW HAVEN RAILROAD

Headcounts-April-August, 1962 vs. 1963
Monday-Friday Totals Only, Inbound and Outbound

Route Figures Include Inbound and Outbound	April 1962	April 1963	% Change	May 1962	May 1963	% Change	June 1962	June 1963	% Change	July 1962	July 1963	% Change	August 1962	August 1963	% Change
Providence															
Peak	58687	58360	– 0.6	58533	60218	+ 3.0	48721	49808	+ 2.2	50322	51238	+ 1.8	47846	51893	+ 8.5
Off-Peak	27171	30987	+14.0	26220	31067	+18.0	21466	24640	+14.8	21482	26020	+21.1	20485	27584	+34.7
Total	85858	89347	+ 4.0	84753	91285	+ 8.0	70187	74448	+ 6.1	71804	77258	+ 7.6	68331	79477	+16.3
Needham															
Peak	73635	72572	– 1.0	76373	75335	– 1.4	66225	63349	– 4.3	67068	63830	– 4.8	63303	64422	+ 1.8
Off-Peak	12651	15049	+ 2.4	12718	15400	+21.0	10012	12307	+32.9	10220	12863	+35.6	10279	13392	+30.7
Total	86286	88221	+ 2.2	89091	90735	+ 2.0	76237	76656	+ 0.5	77288	77693	+ 0.5	73552	77814	+ 5.8
West Medway															
Peak	1204	1051	–13.0	1281	1146	–10.5	1105	941	–14.8	1277	976	–23.6	1113	964	–13.4
Off-Peak	––	––	––	––	––	––	––	––	––	––	––	––	––	––	––
Total	1204	1051	–13.0	1281	1146	–10.5	1105	941	–14.8	1277	976	–23.6	1113	964	–13.4
Blackstone															
Peak	29510	29864	+ 1.0	29808	29604	– 0.7	24053	25094	+ 4.7	22936	24849	+ 8.3	23145	26103	+12.8
Off-Peak	9994	9463	– 5.3	13172	12954	– 1.7	6016	5913	– 1.7	6823	6918	+ 1.4	6282	6557	+ 4.4
Total	39504	39327	– 0.4	42980	42558	– 1.0	30069	31007	+ 3.1	29759	31757	+ 6.8	29427	32660	+11.0
Dedham															
Peak	9083	9065	– 0.2	9086	9640	+ 6.0	8517	8131	– 4.5	7841	7868	+ 0.3	7484	7587	+ 1.4
Off-Peak	––	––	––	––	––	––	––	––	––	––	––	––	––	––	––
Total	9083	9065	– 0.2	9086	9640	+ 6.0	8517	8131	– 4.5	7841	7868	+ 0.3	7484	7587	+ 1.4
Stoughtan															
Peak	28426	29674	+ 4.4	28312	30383	+ 7.0	24006	24983	+ 4.1	24154	26609	+10.2	24590	27624	+12.3
Off-Peak	––	––	––	––	––	––	––	––	––	––	––	––	––	––	––
Total	28426	29674	+ 4.4	28312	30383	+ 7.0	24006	24983	+ 4.1	24154	26609	+10.2	24590	27624	+12.3
Total															
Peak	200545	200586	+ 0.2	203393	206326	+ 1.4	172627	172306	– 0.2	173598	175370	+ 1.0	167481	178593	+ 6.6
Off-Peak	49816	56099	+13.0	52110	59421	+14.0	37494	43860	+17.0	38525	46801	+21.5	37016	47533	+28.4
Total	250361	256685	+ 2.5	255503	265747	+ 4.0	210121	216166	+ 2.9	212123	222161	+ 4.7	204497	226126	+10.6

Source: Trainmen's Head Counts. New Haven Railroad

the B&M. In total, 68 per cent of all passengers travelled on inbound trains during the weekday morning peak hours and outbound trains during the afternoon peak hours. By comparison, 63 per cent of the B&M riders travelled at the same time. Of the balance of the New Haven riders, 24 per cent rode in the weekday off-peak periods and 8 per cent on weekends.

On the Providence Line there was some variation between passenger service areas in the per cent of peak-hour riders. Almost all of the riders (93 per cent) from the close-in Mount Hope-Readville area rode at peak hours. Further out, 67 per cent of the passengers from the Route 128 — Attleboro segment rode at peak hours. This suggests that the response to off-peak service is greater in communities located some distance from the central city.

The analysis of passenger origins and destinations showed that over 96 per cent of all passengers use South Station-Back Bay as either the beginning or end of their trip downtown. Less than 4 per cent of the riders travel between two stations both located outside of Boston. This fact, together with the peak-hour concentration in travel, indicates that, like the B&M, the New Haven rail service is primarily a commuter service.

The origin and destination analysis also indicated that the patronage was highly concentrated. There are nine major stations with two thousand or more passengers per week which account for 62 per cent of the total riders in and out of Boston. The other 33 stations account for the remainder.

All of these major stations are in passenger service areas on the Providence and Needham Lines. These two lines are the only ones for which rail or rapid transit indicate much promise as an alternative transportation mode.

None of the other lines have any major stations. If rail service on these lines were abandoned, this analysis indicates that it is probable that bus or automobile travel would be a more feasible alternative than rapid transit.

TABLE 21

DISTRIBUTION OF NEW HAVEN PATRONAGE
BY STATION FOR 1963

Passenger Service Area	Station	Per Cent
Providence	Providence	13%
Route 128 – Attlebara	Route 128	10
Route 128 – Attlebaro	Sharon	8
Route 128 – Attleboro	Conton Junction	7
Birds Hill – Needhom Heights	Birds Hill	6
Route 128 – Attlebara	Mansfield	5
Birds Hill – Needham Heights	Needhom Junction	5
Route 128 – Attleboro	Attleboro	4
Birds Hill – Needham Heights	Needhom	4
Subtotal: 9 Stotions		62%
All ather Stations (33)		38
Tatal		100%

Source: New Haven Train Audit os onolyzed by Service Bureou Corporation.

An analysis of tickets used revealed there was little change in the mix of ticket types as a result of the experiment. In the year prior to the experiment, 72 per cent of the passengers used multiple-ride tickets and the remainder, one-way and round-trip tickets. During the experiment the use of commutation tickets declined to 67 per cent and the one-way and round-trip increased to 33 per cent. This would appear to indicate that the off-peak service (where travel is primarily by one-way tickets which were not reduced in price) was relatively more successful in attracting additional passengers than was the fare reduction on commutation tickets.

As might be expected the multiple-ride tickets are used primarily for peak-hour travel. They account for 86 per cent of all tickets used at that time. This is the same proportion as was found on the B&M.

c. Revenue Analysis

Total net revenues earned in Massachusetts intrastate service during the first phase amounted to $2,700 more than in the comparable period of the prior year as shown in Table 34. The results by passenger service area, however, show considerable variation. Revenues on the intrastate portion of the Providence Line increased $32,000. In all other intrastate service areas, revenues declined from $2,000 (Roslindale - West Roxbury) to $13.000 (Bird's Hill - Needham Heights). The total decrease amounted to $29.900.

The interstate portion of the Providence Line, on which service was increased but fares were unchanged, experienced an increase of $11,000. In providing comparability with 1963 data, the 1962 data were adjusted for the elimination of the 10 per cent Federal Excise Tax in November 1962.

Table 22

NEW HAVEN RAILROAD

Headcounts
September – February
1962 vs. 1963
1963 vs. 1964

Monday-Friday Totals Only, Inbound and Outbound

Route Figures Include Inbaund ond Outbound	September		%	October		%	November		%	December		%	Jonuory		%	February		%
	1962	1963	Chonge	1962	1963	Change	1962	1963	Change	1962	1963	Chonge	1962	1963	Chonge	1962	1963	Chonge
Providence																		
Peak	50741	51865	+ 2.2	58615	60794	+ 3.7	49958	52257	+ 4.6	55925	59338	+ 6.2	61832	64574	+ 4.4	53395	59493	+11.4
Off-Peak	21747	28346	+30.3	24459	35525	+45.2	20506	31949	+55.8	24320	42996	+76.8	22512	39345	+74.8	20090	36476	+81.6
Tatal	72488	80211	+10.7	83074	96319	+15.9	70464	84206	+19.5	80245	102384	+27.6	84344	103919	+23.2	73485	95969	+30.6
Needhom																		
Peak				72712	74949	+ 3.1	62995	62003	– 1.5	68673	70838	+ 3.2	82529	81284	– 1.5	69383	72410	+ 4.4
Off-Peak				13763	13645	– 0.9	10963	11839	+ 8.0	12605	15915	+26.3	9574	10593	+10.6	9102	10469	+15.0
Total				86475	88594	+ 2.5	73958	73842	– 0.1	81278	86753	+ 6.7	92103	91877	– 0.2	78485	82879	+ 5.6
West Medway*																		
Tatal				1131	1111	– 1.8	1045	1159	+10.9	1142	1260	+10.3	1295	1385	+ 6.9	1136	1187	+ 4.5
Blackstone																		
Peak				29239	33449	+14.4	26377	27071	+ 2.6	29648	31069	+ 6.6	33613	34441	+ 2.5	29603	31103	+ 5.1
Off-Peak				8729	9841	+12.8	7794	8092	+ 3.8	9172	9621	+ 4.9	9274	9999	+ 7.8	8182	9627	+18.1
Tatal				37968	43290	+14.0	34171	35163	+ 2.9	38820	40690	+ 4.8	42887	44440	+ 3.6	37755	40730	+ 7.9
Dedhom*																		
Total				7475	9118	+22.0	7566	5789	–23.5	8567	8431	– 1.5	9968	9581	– 3.1	8362	8633	+ 3.2
Stoughton*																		
Total				27929	32147	+16.8	23792	26707	+11.4	26585	30542	+14.9	31490	33382	+ 6.0	26311	30530	+16.0
Totol																		
Peak				197101	211568	+ 7.3	171873	174986	+ 1.8	190540	201528	+ 5.8	220727	224647	+ 1.8	188190	203356	+ 8.1
Off-Peak				46951	59011	+25.7	39263	51880	+32.1	46097	68532	+48.7	41360	59937	+44.9	37344	56572	+51.5
Tatal				244052	270579	+10.9	211136	226866	+ 7.4	236637	270060	+14.4	262087	284584	+ 8.6	225534	259928	+15.3

* No off-peak service

Source: Troinmen's Heod Counts. New Haven Railroad

The price of passenger tickets was not reduced when the tax was removed. Since that date an amount equivalent to the tax has been retained by the railroad as incremental revenue. Accordingly, the 1962 data were increased by $41,000 to offset the effect of this change.

2. Phase Two

The second phase of the New Haven experiment, which affected only the Providence Line, was completed March 8, 1964. However, data for all of the New Haven's local East End service were obtained for comparative purposes.

The increase in patronage on the Providence Line was greater than in the earlier phase. However, on the remaining lines, where the experiment had been discontinued, the increase in patronage over the prior year was also greater than it had been in the first phase.

These increases in ridership, together with fare modifications, provided enough added revenue to offset the incremental cost of the experiment and make a small reduction ($21,000) in the overall deficit.

a. Line Totals

Patronage on the intrastate portion of the Providence Line increased 27 per cent over the same period in the prior year (Table 23). The Route 128 — Attleboro segment of the line accounted for almost all of the increase suggesting that off-peak fare reductions attract more passengers who live a considerable distance from the city than those who live in close-in suburban areas. This same result was experienced on the Boston and Maine.

The balance of the Massachusetts intrastate service areas showed an increase of 5 per cent. The Providence interstate traffic which benefitted from the additional off-peak service had a 10 per cent increase in patronage. These increases were greater than during the first phase. The reason for this apparent improvement is that the traditional loss in passengers that follows the summer vacation period did not occur in 1963 as had been the case in 1962. An exact determination as to why the drop-off did not occur was not made because of the small magnitude of riders involved.

b. Revenue Analysis

Revenues on the Massachusetts intrastate portion of the Providence Line increased $59,000 over the comparable pre-experiment period. Although the interstate portion of that line was not included in the second phase of the experiment, it did benefit from the additional off-peak service to the extent of a $31,000 increase in revenue. Thus the total increase in the second phase amounted to $90,000 — substantially the same as the incremental costs of the second phase.

It is interesting to note, however, that in all other intrastate areas which were not included in the second phase of the experiment, and where service and fares were at pre-experiment levels, there was a revenue increase of $23,000.

TABLE 23

NEW HAVEN REVENUE PASSENGERS – FIRST PHASE
(Thousands)

Passenger Service Area	1963	1962	Percent 1963 aver/ (under) 1962
Fare Reduction - Service Increase			
Providence Line:			
Mount Hope-Readville	62.3	53.5	16.4%
Route 128-Attlebora	508.1	411.3	23.5
Subtotal	570.4	464.8	22.7
Needham Line:			
Roslindale-West Roxbury	150.1	144.8	3.7
Bird's Hill-Needham Heights	240.2	235.9	1.8
Subtotal	390.3	380.7	2.5
Fare Reduction - Service Unchanged			
Charles River-West Medway	6.0	6.7	(10.4)
Endicott-Blackstone	182.0	180.9	0.6
East Dedham-Dedham	12.8	12.7	0.8
Canton-Stoughton	57.1	62.9	(9.2)
Subtotal	257.9	263.2	2.0
Intrastate Total	1,281.6	1,108.7	9.9
Fare Unchanged - Service Increase			
Providence Line-Interstate	226.2	219.0	3.3
Grand Total	1,444.8	1,327.7	8.8%

REVENUE PASSENGERS – SECOND PHASE
(Thousands)

Passenger Service Area	1963-1964	1962-1963	Percent 1963-1964 aver/ (under) 1962
Fare Reduction - Service Increase			
Providence Line:			
Mount Hope-Readville	64.5	61.8	4.4%
Route 128-Attlebora	626.8	481.5	30.2
Subtotal	691.3	543.3	27.2
Fare and Service Unchanged			
All other intrastate areas	723.3	690.7	4.7
Intrastate Total	1,414.6	1,234.0	14.6
Fare Unchanged - Service Increase			
Providence Line-Intrastate	246.7	223.4	10.4
Grand Total	1,661.3	1,457.4	14.0%

Source: N. H. head counts, train audits, and station sales reports.

IV. New York Central Railroad

The New York Central did not participate in the MTC demonstration experiments, and maintained substantially the same service and fare structure on its Boston commuter operations in 1962 and 1963. New York Central officials supplied data on passenger volumes. This permitted the use of the New York Central as a control group to be compared with the two railroads where experimental changes were made. Without the impetus of a demonstration experiment

involving service and/or fare changes, patronage on the New York Central commuter service to Boston continued downward in 1963. Figures for the first week of each month showed that from January through November, the average passenger-volume decline on Boston commuter trains was 5.9 per cent from the same period in 1962. A similar trend had been evident on the Boston and Maine and the New Haven prior to the initiation of the MTC Demonstration Project. The New York Central experience indicates that during the demonstration period, there were no outside factors that would have reversed this downward trend in patronage on the other two Boston railroads. Thus, it is reasonable to assume that without the experiments, their passenger volume would have continued to drop at about the same rate.

TABLE 24

COMPARISON OF THE PERCENTAGE CHANGE IN NEW YORK CENTRAL (B&A) PASSENGER VOLUME WITH THAT ON THE NEW HAVEN AND THE BOSTON AND MAINE IN 1963

Month	NYC[1]	B&M[2]	NH[2]
January	– 4.3%	+21.4%	N.A.
February	– 5.5	+25.5	N.A.,
March	– 8.1	+25.2	N.A.
April	– 6.0	+25.9	+ 2.5
May	– 5.7	+26.8	+ 4.0
June	– 2.8	+27.0	+ 2.9
July	–17.5*	+28.1	+ 4.7
August	– 5.3	+32.2	+10.6
September	– 6.3	+29.7	N.A.
October	– 6.1	+37.7	+10.9
November	– 9.2	+30.3	+ 7.4
December	N.A.	+36.4	+14.4

1) Percentage change in passenger volume of one week each month over a comparable week of the previous year. (Based on Headcounts)

2) Percentage change in passenger volume for full month as compared to the same month of the previous year. (Based on Headcounts)

* The July figures distorted by the influence of July 4th which fell on a different day of the week in 1962.

V. Findings

The rail experiments demonstrated conclusively that additional passengers can be attracted to the railroads. Frequent service and well maintained equipment are of greater importance than reduced fares.

On the New Haven Railroad, fares on all routes were reduced by approximately 10 per cent during the first phase of the experiment, while service was increased on only two routes. Increased patronage occurred only on the lines that had increased service.

The results on the Boston and Maine were even more significant. During the first phase, patronage increased materially on those lines where service was increased and fares reduced. On the Bedford and Hudson routes, where fares were reduced and service was not changed, ridership was unaffected. In the second phase of the experiment, service on the B&M was maintained but peak-hour fares were increased to pre-experiment levels. Despite the increase in fares, patronage continued to rise. However, a further reduction in off-peak fares below the level of the first phase failed to generate any significant increase in riders.

Adjustments in frequency on different lines of the B&M during the third phase proved conclusively that frequency is the most important factor in increasing passenger volume in railroad commuter service.

The chief operational findings of the railroad experiments are:

1. Additional passengers can be attracted to both peak and off-peak railroad suburban service.

2. Frequency of service is a more important factor than lower fares in both retaining present passengers and attracting additional passengers to railroad suburban service.

3. Increases in commuter fares, when accompanied by a continuation of a high level of frequency of service, do not necessarily result in decreases in passenger volumes.

Chapter Four

Rail Costs Analysis

The material in this chapter is based upon cost studies of railroad commuter service in the Greater Boston region prepared for the Mass Transportation Commission by McKinsey & Company, Inc. This study forms an important part of the overall MTC Demonstration Project and purpose. It analyzes railroad commuter passenger costs to determine variable, incremental and avoidable *cash* costs as distinct from fully allocated costs according to the established Interstate Commerce Commission (ICC) formulae.

To illustrate the magnitude of difference between the passenger loss as determined by the ICC formulae and the passenger loss as determined on an avoidable cash cost basis, the B&M 1963 ICC passenger loss was $4.1 million as compared to an avoidable cash loss of $2.7 million, based on the mix of revenue levels in effect during the MTC experiment (both of these losses exclude payments made by the MTC).

McKinsey & Company, Inc. has prepared a Supplement to this Report which develops the methodology and material contained in this chapter in much greater technical detail.

I. Commuter Railroad Service Costs

McKinsey & Company, Inc. analyzed the commuter railroad service costs for each of the three railroads serving the greater Boston region. Separate detailed analyses were made of the B&M and the New Haven railroads, whose participation in the MTC Demonstration Project experiments facilitated the in-depth approach. Although it did not participate in the Demonstration Project experiments, the New York Central Railroad cooperated in a cost analysis of its commuter service in the greater Boston region. However the methodology and analysis of the New York Central Boston commuter service necessarily differed in depth from the analyses of the B&M and New Haven railroads.

A. Costs of B&M Experiments

It was recognized that the experiment would increase B&M operating costs. One question to be answered by the Project was the extent the gains in patronage would offset the reductions in revenue from the fare reductions and the increased cost arising from the increased services.

The added costs actually incurred in conducting the experiments were of two types: start-up costs and incremental operating costs.

1. Start-Up Costs

Start-up costs are composed of several one-time costs, (such as reactivating 14 Budd cars) that were incurred prior to the experiment to enable the railroad to provide increased service. The costs of this type totaled $187,000.

TABLE 25

B&M START-UP COSTS
FIRST PHASE

Type of Cost	Amount
Maintenance of way and structures[1]	$ 21,700
Maintenance of equipment[2]	132,900
Traffic[3]	5,300
Transportation[4]	22,300
Nonoperating[5]	4,800
Total	$187,000

1. Maintenance of way costs were those incurred by an increase in capacity of the signalling system at North Station and in specific track modifications on the Reading line necessitated by increased service levels.
2. Maintenance of equipment costs were those involved in repairing and restoring to service 14 Budd cars that had been in storage, and the expenses entailed in improving the cleanliness, appearance, and rider comfort of the 93 units already in service.
3. Traffic costs represented the incremental expense of printing new timetables.
4. Transportation costs were those incurred in making the January 1963 schedule change, including preparing and distributing crew run assignments; printing employee timetables; and filing revised rate tariffs, and plates for new tickets.
5. Nonoperating costs were comprised of railroad retirement and unemployment taxes for the employees performing the start-up work described above.

Source: McKinsey & Company, Inc.

Start-up costs for the second phase of the experiment were minimal — some $500 covering printing plates for off-peak tickets and cost of filing revised tariffs. Start up costs for the third phase were approximately $10,500 and represented the expense involved in printing employee and passenger timetables.

2. Incremental Costs

a. Phases One and Two

The continuing incremental costs of the experiment amounted to $101,400 per month (Table 26), or about $1.2 million on an annual basis. These cost determinations are based on first quarter 1963 operating results. However, an examination of total costs for the year indicates that there was no substantial change in the level of these costs during 1963.

The major increases in cost were in the "above rail" accounts which include train and engine crews, passenger car repairs, train supplies, and fuel. These accounts represented 83 per cent of the total incremental costs.

Supervisory, clerical and nonoperating personnel accounted for nine per cent of the incremental costs, and represented added supervisors in the Maintenance of Equipment and Transportation Departments, signal and switch operators, and additional employees in revenue accounting.

Advertising and supplies represented three per cent of the added costs, and included heavier outlays for passenger advertising than in 1962, additional office supplies, and the

Table 26

BOSTON AND MAINE RAILROAD

Incremental Cost – First, Second and Third Phases

Average Month
(Thousands)

ICC Account	Estimated Cost Change 1st & 2nd Phase*	Third Phase
Operating		
Maintenance of Equipment		
301 Supervision	$ 0.5	$ 0.5
317 Passenger car repairs	16.6	14.1
335 Health and welfare	0.4	0.4
Subtotal	$ 17.5	$15.0
Traffic		
353 Advertising	$ 1.7	$ 1.7
Transportation		
371 Supervision	$ 2.7	$ 2.7
379 Yard switch and signal tenders	0.7	0.7
392 Engine crews	28.9	25.3
394 Train fuel	6.1	4.6
401 Train crews	23.7	19.2
402 Train supplies	8.5	8.5
404 Signal operators	1.0	1.0
409 Health and welfare	0.5	0.5
410 Stationery and supplies	0.9	1.1
Subtotal	$ 73.0	$63.6
General		
452 Salaries and expense – clerks	$ 4.3	$ 4.3
453 General office supplies	0.1	0.1
456 Health and welfare	0.2	0.2
Subtotal	$ 4.6	$ 4.6
Total – Operating Accounts	$ 96.8	$84.9
Nonoperating		
532 Railway tax accruals	$ 4.6	$ 4.0
Total – Average Month	$101.4	$88.9

* Based on cost changes observed during the first phase and recheck in the second phase.

Source: McKinsey & Company, Inc.

extra cost of the coupon tickets. The remaining incremental costs, as represented by health and welfare benefits (one per cent) and retirement and unemployment taxes (four per cent), were direct result of added personnel.

An examination of the change in some of the major accounts reveals some interesting facts regarding the variability of railroad costs. Fuel costs, which tend to vary directly with car miles, increased approximately 40 per cent over 1962 levels. Train and engine crew costs increased about 32 per cent. These costs were incurred primarily because much of the service increase was during the peak periods when the existing crews were already fully utilized and additional crews were required. On a percentage basis, they are less than the overall increase in car miles because the substantial increase in off-peak service provided a greater opportunity to schedule appropriately the time and mileage of available crews.

The passenger car repair account, which normally is considered to vary directly with mileage, increased only 28 per

cent, compared with the 40 per cent increased in car mileage. The reason is that a substantial portion of total repair costs (referred to as time maintenance) are related to regularly scheduled inspection and routine repairs (such as battery replacement) which tend to have a fixed annual cost per unit in service, regardless of mileage run. The balance of the repair costs do tend to vary with mileage.

Other elements of cost showed less variability. The supervisory, clerical, and non operating personnel increased by an annual rate of $100,000 or 11 per cent, of the 1962 level for these types of costs.

b. Incremental costs, phase three

The incremental costs of the third phase, (Table 26) amounted to $88,900 per month. The change in costs from the first two phases of $12,500 is the net result of lower "above rail" costs because of reduced train and car miles ($12,700), and the higher costs of tickets ($200) because of increased ridership during the third phase.

B. Costs of New Haven Experiments

The New Haven Railroad, like the B&M incurred both start-up and incremental costs in conducting the experiment. A major cost element on the New Haven was the car reconditioning and cleaning program which was started in advance of the experiment and lasted throughout the first phase. The costs of this program were included in start-up costs rather than in incremental costs because they were a function of providing equipment for the experiment, and not a recurring cost of the incremental service.

1. Start-Up Costs

The total start-up and car-reconditioning costs for the first experiment amounted to $97,600. The greater portion of these costs, $95,400, was incurred at the South Boston car yard in cleaning, renovating, and repairing six conventional coaches and 22 Budd cars. These costs include base wages and fringe benefits of mechanics and car cleaners engaged in the program and the cost of material used.

The balance of $2,200, represented expenses incurred in making the March schedule change, printing and distributing new passenger and employee timetables, and filing revised fare tariffs.

The start-up costs for the second phase ($2,200) were essentially the same as those for the first phase excluding the car rehabilitation program which was terminated at the end of the first phase.

2. Incremental Costs

The continuing incremental costs of the added service during the first phase amounted to $19,600 per month or a total of $118,000 (Table 27). These costs were based on an examination of the changes in costs reflected in the first three months of phase one as compared with pre-experimental cost levels. The incremental costs for the second phase declined to a level of approximately $15,300 per month due to the elimination of the added service on the Needham Line (Table 27).

The major cost increases during the first phase were in the above-rail accounts which represented 85 per cent of the total, a result similar to that encountered on the B&M. Nonoperating personnel accounted for five per cent of the costs. These costs represented additional trick (shift) coverage and overtime payments to crossing watchmen and station agents. Advertising and supplies (three per cent) costs included spot radio and local newspaper advertisements and the costs of additional tickets. The remaining incremental costs, which included health and welfare benefits (one per agents. Advertising and supplies (three per cent) costs cent) were the direct result of added personnel.

Train and engine crew costs are a significant if not governing influence on the magnitude of incremental costs. In the first phase of the New Haven they represented 38 per cent of the total; in the B&M phase, nearly 52 per cent.

An appropriate balance between peak and off-peak service that permits maximum crew utilization can have a materially favorable effect on incremental crew costs. The first New Haven phase provides a good illustration of this point. The number of trains were increased by 42 per cent over pre-experiment levels, and car miles. by 17 per cent; crew costs increased only 11 per cent. The additional off-peak service permitted greater utilization of crews at a lower relative cost. This same result was experienced to a lesser degree on the B&M.

Conversely, however, it is possible to overbalance the service configuration under the assumption that additional off-peak service is "for free". In this situation the railroad is faced with bringing in additional crews because of the off-peak service demands.

C. Passenger Service Deficits

1. Avoidable Costs

One meaningful way to express a railroad's passenger deficit is in terms of annual cash savings that could be realized if passenger operations were discontinued. To

Table 27

NEW HAVEN

Incremental Costs – Average Month
First and Second Phase

ICC Account	Amount (Thousands) First Phase	Second Phase
Operating		
Maintenance of Equipment		
317 Passenger Car Repairs	$ 4.8	$ 4.1
335 Health and Welfare	0.1	0.1
Subtotal	$ 4.9	$ 4.2
Traffic		
353 Advertising	$ 0.4	$ 0.7
Transportation		
372 Dispatching trains	$ 0.3	$ 0.0
373 Station Employees	0.5	0.2
392 Engine Crews	4.7	3.8
394 Train fuel	2.0	1.6
400 Enginehouse expense	0.4	0.3
401 Train crews	2.8	2.2
402 Train supplies	1.8	1.3
405 Crossing protection	0.2	0.0
409 Health and welfare	0.2	0.1
410 Stationery and supplies	0.2	0.1
Subtotal	$13.1	$ 9.6
Total – Operating Accounts	$18.4	$14.5
Nonoperating		
532 Railway tax accruals	$ 1.2	$ 0.8
Total – Average Month	$19.6	$15.3

Source: McKinsey & Company, Inc.

calculate these savings for the B&M and the New Haven railroads, the avoidable cost approach was used. Under this method, the deficit for each railroad was established by subtracting the revenues that would be lost, from the cash costs that could be eliminated, if a defined level of service were terminated.

The avoidable approach varied markedly from the ICC system of costing used by both railroads to compute passenger service losses.

ICC operating expenses include depreciation while the cash-based avoidable cost approach substitutes principal payments on outstanding obligations for this noncash item. Some avoidable costs, particularly those related to maintenance functions, were developed from standards which reflect average annual costs in order to establish anticipated cash savings over the long term rather than for any single year. In contrast, ICC costs represent actual charges for a given year which may or may not be typical for a particular cost element.

Under ICC procedures, costs not identified as solely related to either freight or passenger operations are designated initially as common costs which are then distributed through a variety of allocation formulas. These apportioned common costs generally account for 25-30 per cent of all passenger operating expenses. However, common expenses were identified as avoidable in this study only if they could be eliminated with passenger service discontinuance.

In summary terms, the ICC system can be described as a fully allocated method which seeks to develop the total cost of a task by assigning all related expenses whether or not they can be eliminated if the task were discontinued. Such a system is not intended to measure the potential impact of passenger service discontinuance on company operations. Recognizing this, the ICC itself states in its published rules governing the separation of costs that:

> "Inasmuch as the amounts assigned and/or apportioned to the freight and passenger service are based on the performance of both services, the operating expenses, taxes, equipment and joint facility rents assigned and/or apportioned to either service may not represent the amounts that could be eliminated if either service were discontinued."

Thus, by measuring actual cash savings that could be realized, the avoidable approach establishes a better base for appraising the impact of alternative solutions on the railroad's deficit problem. These savings, however, should be considered a baseline only because they reflect a break-even point which does not (a) adequately compensate the railroad for managerial talent devoted to passenger operations, and (b) provide a return to the company and its stockholders for invested capital.

Against this background, the following material in this chapter presents the results of the study and the underlying methods and assumptions in the following order:

Description of the general approach used. (Section 2)
Analysis of the passenger service deficit of the B&M. (Section 3)
Analysis of the East End passenger service deficit of the New Haven Railroad. (Section 4)
Discussion of the Boston commuter service of the New York Central Railroad. (Section 5)
Description of the variability of revenues and costs under different configurations and levels of service, including the development and use of a model to test alternative assumptions. (Part II)

2. General Approach

This section provides a framework for these analyses by discussing some of the general elements of the study approach. These are (a) data sources, (b) facilities modifications, (c) use of averages and standards, and (d) costing techniques.

a. Data Sources

Although data sources varied with the cost element under examination, three basic sources were used throughout the study.

i. Reports and records: Data already available in company and department reports and records were used to the maximum extent possible to reduce study time and costs. For

the B&M and the New Haven, these included data in ICC Form A Annual Reports, passenger and freight service timetables, revenue and passenger statistics, track and signal charts, line maintenance reports, rolling stock maintenance records, claims records, insurance registers and a variety of published material.

Access to New York Central reports and records was considerably more limited, since this road was not a participant in the project. Thus, primary reliance was placed on data developed from ICC reports and several petitions for discontinuance of passenger trains.

ii. Interviews: Company personnel on each railroad were interviewed whenever possible to bring their experience to bear in areas where judgments and estimates were required to supplement recorded data. However, the availability of this source varied among the railroads. B&M employees were consulted extensively. Engineering, mechanical, and operating department executives worked closely with McKinsey & Company, Inc. to determine the facilities modifications that could be made if passenger operations were discontinued. The Chief Engineer evaluated the impact of these modifications on maintenance costs. The activities of General Office personnel were reviewed with appropriate department officers and assistants to determine number and types of positions that would not be required in a freight-only operation. Crew runs were analyzed with the Company's consultant on crew-cost matters. The Chief Mechanical Officer provided major assistance in developing rolling stock maintenance costs.

In contrast, this data source was available to a very limited degree on the New Haven. Concurrent with the study of New Haven operations, the Railroad was preparing its own East End discontinuance case. Hence, New Haven officials were reluctant to render opinions until the supporting data for that case were completed. As a result, many elements of the New Haven deficit presented in this report are based on judgments and assumptions not necessarily those of the New Haven management.

Interviews with New York Central personnel were severely limited since the railroad did not participate in the Demonstration Project. New York Central Boston commuter service consists of only 4 trains each way each day, a comparatively small and minor portion of the total New York Central operations in the greater Boston region. Therefore, usable data could be assembled without extensive personal contacts.

iii. Special analyses: Several revenue and cost elements required special analyses to supplement information obtained from reports and interviews. Passenger revenue figures for the B&M and the New Haven were developed from train audits and analyses of station sales in order to separate income by line segments and to segregate through and interstate revenues from Boston suburban revenues. Avoidable costs of miscellaneous supplies and expenses on the B&M were based on a review of all vouchers over $100 for a full test month. New Haven facilities and track maintenance avoidable costs were determined by another method, an analysis of line maintenance records for the years 1961-1963. Avoidable crew costs for both railroads were based on special studies of crew runs and wage agreements.

b. Facilities Modifications

One of the first steps in the study of the B&M and New Haven passenger service deficits was the preparation of a detailed list of facilities modifications which could be made if passenger operations were discontinued. These lists appear in Supplement Two to this report, and are summarized in later portions of this chapter which deal with the individual railroads. The identification of facilities modifications was a key element in each of the railroad analyses, since it provided the basis for determining avoidable costs in such areas as facilities and track maintenance, nonoperating transportation personnel, and utilities, property taxes, and facility insurance.

Facilities modifications for the B&M were developed through a series of meetings with personnel from the B&M operating, mechanical, and engineering departments. The modifications included maintenance of equipment facilities, such as the Boston Engine Terminal; operating facilities, such as towers, track, and signals; and stations used in the passenger service.

New Haven facilities modifications were identified primarily by analyzing track and signal charts and freight service schedules. Although more limited than those possible on the B&M, New Haven modifications did extend to signals, track, and stations.

c. Averages and Standards

The study sought to develop annual cash savings which, with appropriate updating for wage increases, material price changes, and other factors, would reflect typical annual savings rather than those in any given year. Therefore, current costs were used wherever they represented a true picture of expected annual costs. Where current data were not representative, averages and standards were used. B&M facilities and track maintenance costs, for example, were based on estimated average annual costs over the next ten years. B&M crew costs reflect standard crew runs for the level of service that existed during the experiment, costed out according to current wage agreements. Rolling stock maintenance costs for both roads were developed from standards which smoothed out cyclical maintenance costs by determining car life, by identifying all maintenance tasks and their frequency, by pricing out each task over the life of the car, and by translating these calculations into an annual cost figure.

d. Costing Techniques

In costing labor and material items, several basic rules were followed throughout the study to insure consistency between the railroads and among the various functional

areas. Exceptions are specifically noted in the appropriate chapters of Supplement Two to this report.

i. Annual hours: Avoidable labor costs for hourly rated employees were based on a 2,088-hour (261-day) year for positions covered during weekday holidays and vacations. A 2,024-hour (253-day) year was used when weekday holidays were not worked, with an additional 80 hours (ten days) deducted if the position was not covered while the incumbent was on vacation. For positions left uncovered during an employee's unpaid sick leave, annual hours were further reduced by forty (five days).

ii. Hourly rates: Current hourly rates were applied to individual positions. A modal or average rate was used when positions of the same type, but with different rates, could be eliminated. Average rates were also applied to functions handled by several different positions. For example, labor hours for New Haven station maintenance functions were multiplied by the average rate for carpenters, tinsmiths, plumbers, painters, and masons.

iii. Fringe benefits: Computations for holiday and vacation pay, health and welfare benefits, and payroll taxes were based on system-wide percentages (of base compensation) currently used by the railroads.

iv. Material prices: In most cases, material costs were taken from company records. Where physical quantities were costed, current material prices were used.

v. Current economics: Any historical figures used in the study were adjusted as necessary, to current economic levels through the use of appropriate ICC or Association of American Railroads (AAR) indices.

3. Development of B&M Revenues and Costs

The avoidable approach establishes the passenger service deficit in terms of the revenue losses and cost reductions that the railroad would obtain with passenger service discontinuance. In the case of the B&M, discontinuance of passenger service means elimination of all commuter and through-passenger trains except those on the Connecticut River Line. This line was not incorporated in the study because it does not service the Boston area and, hence, neither affects nor is affected by the rest of the system. In contrast, operation of the remaining interstate trains out of Boston would be completely impractical without the commuter service because of the otherwise avoidable costs — such as crossing protection, towers, and equipment maintenance facilities — that would be required. These interstate trains include the shorter runs to Portsmouth, Nashua, Manchester, and Concord (all in New Hampshire), and the through service to Portland, Maine, and White River Junction, Vermont.

Within the framework of this definition, and the general elements of the study approach described earlier in this chapter, the specific methods used to develop B&M revenues and costs can be highlighted through the following items:

Passenger train revenues: The average number of revenue passengers carried per day and the average revenue earned per day are shown in Tables 28 and 29 respectively.

TABLE 28

B&M REVENUE PASSENGERS PER DAY
(Thousands)

	1962	1963	1964
Weekdays			
January	20.3	24.0	27.1
February	19.9	24.7	28.1
March	20.2	24.9	28.0
April	18.9	24.0	
May	18.4	23.3	
June	18.1	22.8	
July	16.7	21.5	
August	16.7	22.4	
September	17.7	23.3	
October	18.7	26.0	
November	17.9	23.7	
December	18.5	26.1	
Saturdays			
January	5.3	8.4	8.6
February	6.1	9.2	10.8
March	5.6	8.6	10.3
April	5.3	7.5	
May	5.2	8.2	
June	4.5	5.9	
July	4.2	5.0	
August	4.2	5.8	
September	4.5	6.6	
October	4.7	7.9	
November	5.4	8.2	
December	6.6	10.3	
Sundays			
January	2.2	2.8	3.5
February	2.5	3.5	4.7
March	2.2	2.9	4.1
April	2.1	3.1	
May	2.2	3.2	
June	2.0	2.6	
July	2.1	2.8	
August	2.1	2.7	
September	1.8	2.6	
October	2.0	3.4	
November	2.1	3.4	
December	2.0	4.0	

Source: B&M train audits and headcounts.

This data is based on an audit of all tickets lifted or honored or cash fares sold on all trains for one week of each month. Audit week revenues were extended to monthly totals by applying the ratio of audit week passenger headcounts to the headcounts for the month. Tables 30, 31 and 32 show the total revenue earned by route for each phase of the B&M experiment.

Revenues in Table 33 represent second phase results projected on an annual basis.

Facilities modifications: The facilities changes the B&M could make following passenger service discontinuance were identified through a series of meetings with personnel from the operations, mechanical, and engineering departments. These modifications, which are presented in detail in Supplement Two to this report, include these major items.

Table 29

BOSTON AND MAINE RAILROAD

Revenue Earned per Day

(Thousands)

	1962	1963	1964
Weekdays			
Jonuory	$12.8	$12.1	$16.1
February	12.6	12.7	16.5
Morch	12.8	12.7	16.5
April	12.0	12.1	
Moy	11.8	11.8	
June	11.5	11.6	
July	10.7	11.2	
August	11.0	12.5	
September	11.4	14.1	
October	12.1	15.4	
November	11.6	14.0	
December	11.9	15.4	
Soturdays			
Jonuory	$ 4.5	$ 5.6	$ 5.1
Februory	5.3	6.0	6.3
March	4.8	5.8	5.8
April	4.6	5.1	
Moy	4.8	5.7	
June	4.2	4.1	
July	4.0	3.2	
August	3.9	3.5	
September	4.1	3.9	
October	4.4	4.6	
November	5.0	4.8	
December	6.0	5.9	
Sundays			
Jonuary	$ 2.3	$ 2.1	$ 2.0
Februory	2.6	2.7	2.7
Morch	2.2	2.3	2.5
April	2.2	2.4	
Moy	2.4	2.5	
June	2.2	2.1	
July	2.4	2.3	
August	2.4	1.8	
September	2.0	1.6	
October	2.2	2.0	
November	2.3	2.0	
December	2.1	2.4	

Source: B&M Train Audits

Maintenance of equipment facilities: The Budd House, now used for passenger operations only, could be eliminated. In addition, three bays of the Boston Engine Terminal roundhouse could be torn down leaving ten storage tracks, the powerhouse, the maintenance of way stores building, the back shop, the turntable, and the sand and fuel facilities.

Interlocking stations: Tower A and the Salem, Lowell Junction, Winchester, and Waltham towers could be retired. The Lawrence tower is required for freight service and the Lynn and Manchester towers could be removed without discontinuing passenger operations.

Signals: Automatic signaling could be retired from Newburyport to Portsmouth, Newburyport to North Beverly, and Reading to Medford. Automatic block signals and Centralized Traffic Control (CTC) could also be eliminated between Ayer and West Cambridge by operating all Fitchburg Division through-freight

TABLE 30

BOSTON AND MAINE EXPERIMENT – REVENUE EARNED

First Phase (Seven Months)

Line	1963	1962	1963 over/ (under) 1962
Weekdays	(Thousands)		
Eastern	$ 522.4	$ 492.3	6.1%
Reading	401.8	403.0	(0.3)
Western	234.4	285.5	(17.9)
Lowell	205.7	186.4	10.4
Woburn	161.1	157.3	2.4
Fitchburg	212.2	191.8	10.6
Sub-Totol	$1,737.6	$1,716.3	1.2%
Bedford and Hudson	39.3	49.3	(20.3)
Totol*	$1,776.9	$1,765.6	0.6%
Weekends			
Eastern	$ 68.8	$ 60.8	13.2%
Reading	26.1	24.9	4.8
Western	44.5	54.3	(18.0)
Lowell	32.2	29.6	8.8
Woburn	15.0	14.3	4.9
Fitchburg	31.1	23.9	30.1
Sub-Totol	$ 217.7	$ 207.8	4.8%
Bedford and Hudson	***	***	***
Totol**	$ 217.7	$ 207.8	4.8%
Grand Totol	$1,994.6	$1,973.4	1.1%

* – Based on 148 days in 1963 and 147 days in 1962.
** – Based on 59 days in 1963 and 60 days in 1962.
*** – No scheduled service.

Source: B&M Train Audits

TABLE 31

B&M EXPERIMENT – REVENUE EARNED

Second Phase (Five Months)

Line	1963	1962	1963 over/ (under) 1962
Weekdays	(Thousands)		
Eastern	$ 463.0	$ 361.4	28.1%
Reading	354.0	282.3	25.4
Western	206.5	206.6	(0.0)
Lowell	172.8	130.3	32.6
Woburn	140.3	113.5	23.6
Fitchburg	184.5	132.8	38.9
Sub-totol	$1,521.1	$1,226.9	24.0%
Bedford-Hudson	35.2	36.5	(3.6)
Totol*	$1,556.3	$1,263.4	23.2%
Weekends			
Eastern	$ 43.3	$ 47.6	(9.0)
Reading	21.6	17.3	24.8
Western	27.2	41.8	(34.9)
Lowell	17.7	19.6	(9.7)
Woburn	11.1	10.0	11.0
Fitchburg	22.0	15.7	40.1
Sub-totol	$ 142.9	$ 152.0	(6.0)%
Bedford-Hudson	***	***	***
Totol**	$ 142.9	$ 152.0	(6.0)%
Grond Total	$1,699.2	$1,415.4	20.0%

* – Based on 109 days in 1963 and 109 days in 1962.
** – Based on 44 days in 1963 and 44 days in 1962.
*** – No scheduled service.

(1) – August 1 through December 31 inclusive.

Source: B&M Train Audits.

traffic into Boston through Ayer and Lowell rather than on the Fitchburg line.

Grade Crossings: All manual crossings could be changed to stop-and-protect. or button-operated flashers, or automatic flashers except the West Medford Crossing. Here, through freight trains on the New Hampshire main line would require automatic gates which could be installed now if they were economic.

Drawbridges: Trick coverage could be reduced on drawbridges in the North Station area and at Beverly, Gloucester, Manchester and Newburyport by leaving them open when freight trains were not operating. With the exception of two drawbridges in the North Station area, which could be easily braced, this procedure would not create any undue strain that might cause sagging or breaking.

Track: Passenger service discontinuance would permit a reduction from double to single track between Beverly Junction and Gloucester, Reading and Medford, and Ayer to West Cambridge.

Stations: 28 stations could be eliminated. None is owned by the B&M, but each has related costs such as rent, heat, light, water and supplies.

TABLE 32

BOSTON AND MAINE EXPERIMENT – REVENUE EARNED
Third Phase (2½ Months).

Line	1964	1962	Percent 1964 over/ (under) 1962
	(Thousands)		
Weekdays			
Eastern	$260.0	$185.5	40.2%
Reading	200.8	155.5	29.1
Western	126.9	112.0	13.3
Lowell	92.0	71.3	29.0
Woburn	73.2	60.6	20.8
Fitchburg	111.2	72.7	53.0
Bedford and Hudson	19.3	18.1	6.6
Subtotal*	$883.4	$675.7	30.7%
Weekends			
Eastern	$ 24.5	$ 20.5	19.5%
Reading	13.6	9.9	37.4
Western	14.7	19.2	(23.4)
Lowell	11.6	11.6	–
Woburn	6.1	5.5	10.9
Fitchburg	18.0	8.8	104.5
Bedford and Hudson***	–	–	–
Subtotal**	$ 88.5	$ 75.5	17.2%
Total	$971.9	$751.2	29.4%

* – Based on 54 days in 1964 and 53 days in 1962
** – Based on 21 days in 1964 and 21 days in 1962
*** – No weekend service

Source: B&M Train Audits

TABLE 33

B&M – PASSENGER SERVICE DEFICIT
Annualized for the year 1963 based on
September and October 1963 Revenues.

Item	Pro Forma Amount
	(Thousands)
Revenues (Passenger related)	
Passenger train	$4,763.5
North Station	94.7
Other	12.3
Total Revenues	$4,870.5
Avoidable Costs	
Facilities and Track Maintenance	
Labor	$ 160.3
Material	85.6
Subtotal	$ 245.9
Rolling Stock Maintenance	
Labor	$1,141.0
Material	595.5
Supplies	100.3
Subtotal	$1,836.8
Transportation	
Train and engine crews	$2,555.2
Nonoperating transportation personnel	877.1
Diesel fuel	284.0
Facility supplies and expenses	75.5
Miscellaneous	62.3
Subtotal	$3,854.1
General	
General personnel	$ 148.0
Insurance	92.2
Claims	168.3
Advertising	35.4
Stationery and Printing	26.8
North Station	90.6
Miscellaneous	25.0
Subtotal	$ 586.3
Railway Tax Accruals	
Railroad retirement	$ 237.4
Railroad unemployment insurance	132.6
Property taxes	60.1
Subtotal	$ 430.1
Debt Payments	
Principal on Budd Cars	$ 400.6
Interest on Budd Cars	54.7
Subtotal	$ 455.3
Total Costs	$7,408.5
Deficit	$2,538.0

Source: McKinsey & Company, Inc.

Facilities and track maintenance costs: Costs in this area were developed through meetings with the Chief Engineer. Most of these costs are directly related to facilities modifications. To determine the impact of these modifications on maintenance expenses, average annual costs were calculated for each affected facility over the next ten years. This approach eliminated the problem of system averages which might not be applicable to an individual facility. It also provided a correction for the cyclical aspect of maintenance tasks which can make figures for any single year unrepresentative.

Rolling stock maintenance costs: Avoidable costs for rolling stock maintenance are based primarily on standards developed through discussions with the Chief Mechanical Officer and others in the mechanical department, and through analysis of maintenance records. Here again, standards are required to smooth out the effects of cyclical tasks, such as heavy engine repairs. To develop these standards costs were divided into two principal categories.

Period costs which are related to units in service and cover such tasks as inspection and lubrication. These costs were established by multiplying the number of avoidable units by the annual costs to keep a unit available for service.

Mileage costs which are related to the miles the equipment travels and include such items as heavy and light engine overhauls. Here, avoidable costs were determined by multiplying avoidable miles by the unit cost per mile, with the latter figure developed through (a) identifying all maintenance tasks and their frequency, (b) estimating average equipment life, (c) pricing out each task over the life of the unit, and (d) translating this price into an annual average.

The reasonableness of standard labor costs was checked against the Chief Mechanical Officer's estimate of the number of positions that could be eliminated without passenger service. This procedure also identified avoidable supervisory positions that were not incorporated in the standards.

Train and engine crew costs: Crew runs were developed by working with the B&M consultant on crew scheduling matters to determine the standard requirements for the experiment level of service. Crew costs were then developed according to existing wage agreements, including arbitraries, vacation allowances, and holiday adjustments. Finally, standards were compared with actual 1963 crew-cost figures, and only minimal differences found.

Debt payments: The figure used as the avoidable principal and interest cost on the Rail Diesel Cars (RDC's) is the average annual payment on existing obligations from 1964 to maturity (1971). This average was used because the time required to sell the cars and pay off the equipment trust could not be forecast.

North Station: Revenues and costs listed under the heading "North Station" do not include items directly related to train operations. Rather, they consist of rentals received from businesses located in the North Station Building and the special expenses related to these businesses.

To determine the impact of discontinuance on revenues, each lease was evaluated in terms of its termination date, type of lease — i.e., fixed amount or share of profits, the likely effect of passenger service discontinuance on the business, and the ability of the lessee to make rental payments if business declined. Based on this review, it was estimated that all North Station revenue would cease with termination of passenger operations except income from (a) The Boston Garden, (b) companies serving the local area — e.g., the bank, bar and restaurant, and drug store, and (c) parking lots, for which the need would increase.

Avoidable costs relate primarily to a reduction in requirements for cleaning, police protection, utilities, and supplies. Because the building would stay open, such items as taxes, insurance, and superintendence would remain unchanged.

4. Development of New Haven Revenues and Costs

The New Haven passenger service deficit calculation was based on discontinuance of East End commuter service. This includes all local commuter trains operating on the main line between Boston and Providence, and on the Branch lines to Needham, West Medway, Blackstone, Dedham, and Stoughton. It does not include the 28 through passenger trains that operate daily between Boston and New York.

Many of the methods used to develop New Haven revenues and costs within this definition of service discontinuance were similar to those applied at the B&M. However, several modifications in the approach used at the B&M were required because of the reluctance of New Haven officials to render judgments or opinions. These modifications and the overall New Haven approach are illustrated below.

Passenger train revenues: Revenues in Table 36 are 1963 figures developed primarily from New Haven station sales reports covering East End local revenues to and from Boston. Revenue figures on local travel and cash fare were developed separately from the April 1963 train audits and are shown in Tables 34 and 35.

Facilities modifications: Existing facilities were identified by examining track and signal charts and through discussions with New Haven personnel. Facilities which would be required after discontinuance were determined by further analysis of track and signal charts and a study of schedules for remaining freight and through-passenger trains.

The retention of through passenger trains on the Boston-Providence Line, and the operation of through freight trains on that Line and the Blackstone Line, severely limit the facilities modifications that could be made. No maintenance of equipment facilities could be eliminated. All interlocking stations would be retained as would automatic signalling from Boston to Providence and Readville to Norwood Central. In addition, several of the larger stations on the Boston-Providence Line would be required for through passenger trains.

The modifications that could be made after discontinuance are these:

Signal systems on the Blackstone Branch between Walpole and Blackstone, and on the Needham, West Medway, Dedham and Stoughton branches could be eliminated.

The one manual crossing at Needham could be changed to a button-operated flasher.

The Blackstone Line could be single tracked from Readville to Norwood, and the four tracks on the Boston-Providence Line, reduced to double track between Back Bay and Mothers Brook (South of Hyde Park).

Stations, shelters, or platforms could be eliminated at 31 locations.

Facilities and track maintenance costs: Avoidable facilities and track maintenance costs were developed primarily through analyses of historical data contained in New Haven Line Maintenance Reports. These reports provide a monthly cost breakdown by segment of track and by function or task within each segment. For each cost category, a three-year average (1961-1963) was used to help correct for the cyclical nature of maintenance tasks. The average could not be extended over a longer period because 1961 was the first year of the Line Maintenance Report.

TABLE 34

NEW HAVEN EXPERIMENT – REVENUE EARNED – FIRST PHASE

Passenger Service Area	1963	1962 Actual	1962 Excise Tax	1962 Pro Forma	% 1963 Over/ (Under) Pro Forma 1962
Fare Reduction - Service Increase		(Figures in Thousands)			
Providence Line					
Mount Hope-Readville	$ 29.0	$ 27.6	$ –	$ 27.6	5.1%
Route 128-Attleboro	351.9	312.1	8.6	320.7	9.7
Subtotal	$ 380.9	$ 339.7	$ 8.6	348.3	9.4
Needham Line					
Raslindale-West Rox.	$ 65.1	$ 67.2	$ –	$ 67.2	(3.1)
Bird's Hill-Needham Hts.	136.5	147.2	1.8	149.0	(8.4)
Subtotal	$ 201.6	$ 214.4	$ 1.8	$ 216.2	(6.8)
Fare Reduction - Service Unchanged					
Charles River-West Medway	$ 4.8	$ 5.3	$ *	$ 5.3	(9.4)
Endicott-Blackstone	125.4	129.4	2.6	132.0	(5.0)
E. Dedham-Dedham	7.1	7.9	*	7.9	(10.1)
Canton-Stoughton	40.2	47.2	0.4	47.6	(15.5)
Subtotal	$ 177.5	$ 189.8	$ 3.0	$ 192.8	(7.9)
Intrastate Total	$ 760.0	$ 743.9	$13.4	$ 757.3	0.4
Fare Unchanged - Service Increase					
Providence Line-Interstate	$ 345.6	$ 306.7	$27.9	$ 334.6	3.3
Grand Total	$1,105.6	$1,050.6	$41.3	$1,091.9	1.3%

* - Less than $50.00
Source: New Haven Railroad.

TABLE 35

NEW HAVEN EXPERIMENT – REVENUE EARNED – SECOND PHASE

Passenger Service Area	1963-1964	Actual	Excise Tax	Pro Forma	Percent 1963-1964 over/ (under) Pro Forma 1962-1963
Fare Reduction - Service Increase		(Thousands)			
Providence Line					
Mount Hope-Readville	$ 32.2	$ 31.1	$.–	$ 31.1	3.5%
Route 128-Attleboro	421.7	360.6	3.0	363.6	16.0
Subtotal	$ 453.9	$ 391.7	$ 3.0	$ 394.7	15.0
Fare and Service Unchanged					
All other intrastate areas	$ 455.0	$ 431.3	$ 1.4	$ 432.7	5.2
Intrastate Total	$ 908.9	$ 823.0	$ 4.4	$ 827.4	9.8
Fare Unchanged - Service Increase					
Providence Line - Interstate	$ 379.1	$ 339.5	$ 8.4	$ 347.9	9.0
Grand Total	$1,288.0	$1,162.5	$12.8	$1,175.3	9.5%

Source: New Haven Railroad.

Facilities and track maintenance avoidable costs arose from two sources: (a) elimination of facilities, and (b) general reduction in track and roadbed requirements resulting from the decrease in traffic. Costs related to facilities changes could be developed, for the most part, directly from Line Maintenance Report figures. In calculating general track and roadbed maintenance costs, percentage savings were estimated for each function and then applied to the 1961-1963 average cost for that function.

Rolling stock maintenance costs: Avoidable costs related to rolling stock maintenance were based primarily on standards developed through the same general approach used for the B&M. New Haven calculations, however, required unit costs for standard locomotives, coaches, and Budd cars, since both conventional and RDC equipment are used in East End local service. In addition, special analyses were needed because the New Haven cost reporting system separates expenses into various systemwide cost centers. For some cost elements, cost center data could be combined to obtain East End totals. For others, development of avoidable costs required the identification and analysis of the various kinds of costs incurred in providing local East End service to determine the applicable portion of the total costs associated with a cost center.

Train and engine crews: Avoidable costs for train crews and engine crews were developed from a study made by the New Haven Railroad of East End crew time slips for the week ending November 17, 1962. The study included train crew costs for both local and through-passenger trains. Hence, the figures were reduced by the through-train portion. In addition, crew costs were increased to reflect expenses of

TABLE 36

NEW HAVEN RAILROAD PASSENGER SERVICE DEFICIT BASED ON ANNUALIZATION OF APRIL 1963 REVENUES.

Item	Amount (Thousands)
Lost Revenues	
Passenger Train	$1,949.7
South Station	25.3
Other	9.2
Total Revenues	$1,984.2
Avoidable Costs	
Facilities and Track Maintenance	
Labor	$ 66.5
Material	13.5
Total Facilities and Track Maintenance	$ 80.1
Rolling Stock Maintenance	
Labor	$ 560.3
Material	252.3
Supplies	18.5
Total Rolling Stock Maintenance	$ 831.1
Transportation	
Train and Engine Crews	$ 970.8
Nonoperating Personnel	164.2
Diesel Fuel	120.5
Crew service expenses	1.6
Station supplies and expenses	2.4
Total Transportation	$1,259.5
General	
General Personnel	$ 49.4
Insurance	11.9
Claims	112.5
Advertising	10.0
Stationery and Printing	13.3
South Station	31.7
Other	4.0
Total General	$ 232.8
Taxes	
Railroad Retirement and railroad unemployment insurance	149.9
Property	9.1
Total Taxes	$ 159.0
Debt Payments	
Principal on rolling stock	$ 95.4
Interest on rolling stock	18.3
Total Debt Payments	$ 113.7
Total Costs	$2,676.2
Deficit	$ 692.0

Source: McKinsey & Company, Inc.

a Dover Street switching crew that could be eliminated with passenger service discontinuance.

Nonoperating transportation personnel: Personnel in this category include train dispatchers, ticket agents, crossing tenders, and towermen. Positions which can be eliminated for the B&M were identified through discussions with the Boston Division Superintendent. On the New Haven where this opportunity was not afforded, avoidability was determined by analyzing current personnel levels and changes in work load that would result from passenger service discontinuance.

South Station: South Station is currently set up as a separate corporation, with the New Haven and New York Central sharing the annual loss in a 70-30 ratio. Corporate financial statements showed that in 1962, the New Haven's share of the loss was $1.5 million. However, since this included noncash depreciation and local property taxes of $800,000 the New Haven's net cash loss was $700,000.

To determine the potential impact of discontinuance of passenger service on South Station operations, South Station revenues and costs were eliminated in two stages. First, the passenger deficit figures appearing in Table 36 were developed under the assumption that no changes in South Station facilities would be made as a result of passenger service discontinuance. Based on this assumption, revenues and cash costs would be reduced by $36,000 and $49,000, respectively, for a net gain of $13,000, of which the New Haven's share would be $9,000.

A second estimate was then developed assuming that the present South Station building and approximately 50 per cent of the land would be sold. The building would be replaced by a $1 million, 300 by 300-foot Butler-type structure which would serve as a station and as a facility for handling railway express and baggage. Under this assumption, the New Haven would realize a total gain of $370,000 including non-cash items, but an additional cash loss of $22,000. Thus, the primary benefits from facilities changes at South Station would be the proceeds from sale of the present building and part of the land. This is especially true since the figures presented above make no allowance for rental payments that might be required to replace space in the present building now occupied by New Haven employees and the YMCA. However, a change in the local property tax situation could alter the South Station picture dramatically. At present, local property taxes are accrued but not paid. Hence, they have been treated as a noncash item. Should the New Haven be required to pay these taxes on an annual basis, the facilities modifications outlined above would result in a net cash gain to the New Haven of nearly $300,000.

The seven items discussed above indicate the heavy reliance on recorded data that was required in analyzing New Haven avoidable costs. This fundamental aspect of the New Haven study is also underscored in the detailed analyses of these and other items appearing in Supplement Two to this report.

5. New York Central Boston Commuter Service

The New York Central did not participate in the experimental portion of the MTC Demonstration Project, and maintained substantially the same service and fare structure on its Boston commuter operations in 1962 and 1963. Without the impetus of a demonstration experiment involving

service and/or fare changes, patronage continued downward in 1963. Figures for the first week of each month showed that from January through June, the average passenger-volume decline on Boston commuter trains was 5.4 per cent from the same period in 1962. A similar trend had been evident on the B&M and the New Haven prior to the initiation of the MTC Demonstration Project.

As stated earlier in this chapter, access to New York Central personnel and records was severely restricted. As a result, it was not possible to calculate the revenue losses and cost savings that would obtain if Boston commuter service were discontinued. However, an overall look at the Railroad's Boston commuter operations suggests that avoidable costs would likely be confined largely to above-rail expenses for crews, fuel, and equipment maintenance. Two factors in particular lead to this finding.

The Boston commuter service does not constitute a significant part of the New York Central's total operations. Hence, discontinuance of this service would have little impact on supervisory positions or facilities such as shops and engine-houses.

The line used by the commuter trains also handles through freight trains and the through-passenger trains to Chicago. Therefore, facilities modifications would be limited.

Termination of commuter trains might permit modest reductions in nonoperating transportation personnel, e.g., station agents and ticket sellers. (Such reductions, however, would not substantially affect the deficit). A further discussion of the New York Central commuter service is incorporated in Supplement Two.

II. Cost Variability Model

As a final step in studying the railroads' passenger service deficits, costs were analyzed to determine their responsiveness to varying service conditions. The purpose of this analysis was to develop a model which would provide a relatively easy way to predict the costs that would be incurred under different configurations and levels of service.

A. Approach

To develop a usable cost prediction model, the variability analysis was based on B&M experience and figures. This means that while the model is of general use to any railroad with commuter operations, adjustments would be required for individual applications. Within the framework of the B&M data, the analysis consisted of four major steps.

A base or minimum level of service was established. This was generally defined as the level below which operations would be so uneconomic that they would not represent a feasible alternative.

Applying this definition to the B&M, minimum service was considered to be two trains (1 round trip) during the morning peak and two trains (1 round trip) during the evening peak on each of the commuter lines. There would be no week-end service, and all trains would have four cars except Bedford and Hudson trains, which would have two cars for a total of 32 cars in service.

Costs were classified into five major categories. These include system fixed and semifixed, line fixed and semifixed, and variable.

> System fixed costs are those incurred if minimum service were run on any or all lines and which would remain constant at service levels above the minimum level. They include such items as maintenance, insurance, and property tax costs related to required facilities.
>
> System semifixed costs are those not assignable by line segment that vary in a nonlinear manner with volume. This category covers a variety of costs such as general personnel, claims, advertising, and principal and interest on equipment.
>
> Line fixed costs are those assignable to a particular line that would be incurred if minimum service were run on that line and which would remain constant at service levels above the minimum level. They consist primarily of maintenance costs for facilities located on the line.
>
> Line semi-fixed costs are also assignable to a particular line, but vary in a nonlinear manner with volume on that line. They include such costs as nonoperating transportation personnel and freight interruption expenses.
>
> Variable costs are those that vary directly with volume and hence, can be assigned to lines in proportion to the volume on each. Variable costs include rolling stock mileage repairs, crews, and fuel. Crew costs are not strictly variable. However, they have been so classified because a special prediction model has been developed for this cost element.

B&M avoidable costs were assigned to the five major cost categories. The results of this step are presented in Table 37. Analysis of this table shows that 59 per cent of all costs are assignable by line with variable costs accounting for 83 per cent of the total. Approximately 70 per cent of total rolling stock maintenance costs have been classified as system semifixed. This is due primarily to the assignment of all time maintenance costs to this category. These costs vary with cars in service which, for the most part, can be related to individual lines. However, total equipment needs depend in part on the overall service configuration of all lines.

B. Cost Prediction Model

To develop a cost prediction model a determination was made of the B&M costs that would be incurred at the minimum or base level of service. This total was then compared with the costs incurred at the pre-experiment and experiment levels of service. Through analysis of the patterns established by these three service-level reference points, cost curves were established for both corporate and line semi-

TABLE 37

B&M AVOIDABLE COST VARIABILITY BY VARIABILITY CATEGORY

Item	Variability Category: System Fixed	System Semifixed	Line Fixed	Semifixed	Variable	Total
			(Thousands)			
Facilities and Trock Maintenance						
Labor	$101.7	$ –	$ 47.9	$ 10.7	$ –	$ 160.3
Material	57.0	–	24.3	4.3	–	85.6
Subtotal	$158.7	$ –	$ 72.2	$ 15.0	$ –	$ 245.9
Rolling Stock Maintenance						
Labor	$ –	$ 915.7	$ 20.1	$ 42.2	$ 163.0	$1,141.0
Material	–	268.3	–	–	327.2	595.5
Supplies	–	100.3	–	–	–	100.3
Subtotal	$ –	$1,284.3	$ 20.1	$ 42.2	$ 490.2	$1,836.8
Transportation						
Train and engine crews	$ –	$ –	$ –	$ –	$2,555.2	$2,555.2
Nonoperating transportation personnel	44.0	345.6	34.5	453.0	–	877.1
Diesel fuel	–	–	–	–	284.0	284.0
Facility supplies and expenses	29.5	–	27.5	18.5	–	75.5
Miscellaneous	37.8	–	–	19.0	5.5	62.3
Subtotal	$111.3	$ 345.6	$ 62.0	$490.5	$2,844.7	$3,854.1
General						
General personnel	$ 37.5	$ 110.5	$ –	$ –	$ –	$ 148.0
Insurance	6.2	85.4	0.6	–	–	92.2
Claims	2.6	117.9	1.5	7.0	39.3	168.3
Advertising	–	35.4	–	–	–	35.4
Stationery and printing	11.0	15.8	–	–	–	26.8
North Station	90.6	–	–	–	–	90.6
Miscellaneous	25.0	–	–	–	–	25.0
Subtotol	$172.9	$ 365.0	$ 2.1	$ 7.0	$ 39.3	$ 586.3
Taxes						
Railroad Retirement	$ 8.6	$ 64.5	$ 4.9	$ 23.7	$ 135.7	$ 237.4
Railroad Unemployment Insurance	4.8	36.0	2.7	13.3	75.8	132.6
Property taxes	59.8	–	0.3	–	–	60.1
Subtotal	$ 73.2	$ 100.5	$ 7.9	$ 37.0	$ 211.5	$ 430.1
Debt Payments						
Principal on Budd cars	$ –	$ 400.6	$ –	$ –	$ –	$ 400.6
Interest on Budd cars	–	54.7	–	–	–	54.7
Subtotal	$ –	$ 455.3	$ –	$ –	$ –	$ 455.3
Total	$516.1	$2,550.7	$164.3	$591.7	$3,585.7	$7,408.5

Source: McKinsey & Company, Inc.

fixed costs. These curves combined with fixed cost levels and variable cost measures make up the model.

The model itself is presented in detail in Supplement Two to this report. In summary, use of the model involves seven steps:

Establish desired number of available seats by line during peak-hour service.

Establish desired level of service by line during off-peak hours.

Compute car miles by line and total equipment requirements.

Calculate crew costs by applying the train and engine crew model.

Apply variable unit costs to appropriate volume measures.

Apply semifixed cost curves to appropriate volume measures.

Summarize fixed, semi-fixed and variable costs.

The principal feature of the model is that it provides approximate costs with sufficient accuracy to enable the evaluation of alternative service levels and configurations quickly and easily. Tests of the train and engine crew cost model against actual conditions showed an accuracy rating of about 5 per cent over or under the actual situation. This is sufficiently accurate to determine the acceptability or non-acceptability from a cost standpoint of any service configuration. Once an optimum level of service from the standpoint of frequency and costs is determined through use of the model, more precise costing of the selected service can be undertaken.

III. Findings

The findings resulting from the cost analyses are divided into three parts, the specific findings for the B&M and New Haven commuter services, and findings generally applicable to railroad commuter operations in other urban regions.

A. B&M Passenger Service Deficit

The Boston and Maine passenger deficit, based on results of the first phase of the experiment, was calculated by the avoidable method at $3.1 million annually. This figure is the net of expected revenue losses of $4.3 million and estimated cost reductions of $7.4 million, if service at the first-phase level were discontinued. In the second phase, revenues increased to an annual rate of $4.9 million without change in costs, thereby reducing the calculated cash deficit to $2.5 million. During the brief third phase, there were further revenue increases to $5.3 million and slight cost reductions ($0.1 million). This resulted in an annual deficit of $2.0 million. The results of the second phase have been used in this study (Table 33) since it was long enough to provide a reasonable basis for developing annual data, and the high levels of revenues, which it represents, have been confirmed by the brief subsequent phase. Further analysis of this deficit leads to the following conclusions:

Although the potential cash recovery of $2.5 million per year is substantial, it presents a conservative picture of the savings to be derived from discontinuance of passenger service for several important reasons.

First, the figures used in developing avoidable principal and interest payments represent the average annual cost over the remaining life of existing equipment obligations on the rail diesel cars. This figure is approximately $1.5 million below the annual cost the B&M would incur if it were providing for replacement of the present fleet on the basis of the average useful life of the equipment. In addition, the study takes no cognizance of the savings, in terms of changes in yard locations and related facilities modifications, the B&M could derive from a freight-only operation. The potential cash recovery does not include any interest or investment return on proceeds from the sale of land, terminal facilities at North Station, passenger equipment, or facilities that could be eliminated with termination of passenger service. Finally, the avoidable cost study did not include the intangible value of executive time devoted to passenger problems.

Even under unfavorable circumstances, the B&M could reduce its annual cash drain from passenger service below the level of the present deficit (2.5 million) during the first year of discontinuance. This conclusion is based on an analysis of the speed with which passenger-related costs could be eliminated. Avoidable costs were classified as immediate (within thirty days), within one year, and after one year, based on factors such as time required for facilities changes, and Massachusetts Department of Public Utilities and Interstate Commerce Commision approvals. Assuming that "within one year" costs would be eliminated after nine months, losses in the first year would drop from the present $2.5 million level to a range from $1.8 million to $1.3 million, depending on how rapidly the B&M could avoid the "thirty-day" costs. After the first year, the cash drain would level off to about $0.5 million until the Budd cars were sold, at which time it would be eliminated entirely. Thus, the B&M would not face the problem of an unacceptable impact on its cash position because of immediate revenue losses and delayed cost eliminations.

Increased service will not eliminate or significantly reduce the current deficit. This fact was made clear by the Demonstration Project. During the three phases of the experiment, a fare and service pattern was developed that attracted more passengers and produced sufficient revenues to offset the incremental costs of the increased service. Further service and fare refinements which would probably reduce the cash deficit by another quarter of a million dollars or more could be satisfactorily instituted as a result of the facts learned in the third phase.

Fare increases cannot be expected to offset all of the deficit because the large (about 50 per cent) increase required would undoubtedly produce a significant drop in patronage. However, on the basis of experiment results, more reasonable fare increases might not materially affect patronage and, hence, could provide substantial help.

Together, these four findings point to the need for outside support of the B&M passenger service if it is to remain in operation. The B&M cannot afford the present cash drain from its commutation service. In view of the B&M's strained financial condition its minimal cash reserves, its heavy capital debt payments, and its recently declining freight revenues, service reduction and fare increases do not, in themselves, offer a practical alternative to discontinuance.

B. New Haven Passenger Service Deficit

The New Haven's East End passenger service deficit, calculated by the avoidable method, is $0.7 million annually (Table 36). This figure is based on expected revenue losses of $2.0 million and anticipated cost savings of $2.7 million, if the first phase level of passenger service were discontinued. Lost revenues do not include about $300,000 from East End commuters who ride the through trains on the Boston-Providence Line. These trains would be retained, and it is reasonable to assume that their commuter patronage would continue.

The New Haven East End deficit is considerably smaller than that of the B&M. However, in analyzing this figure, four points should be considered.

1. The potential recovery, through passenger service discontinuance, of $700,000 presents a conservative picture because it does not include any return on proceeds from sale of lands or facilities. In addition, the existing deficit assumes

that no modifications would be made in South Station facilities after commuter service discontinuance. Calculations show that under present conditions, where local property taxes are accrued but not paid, South Station modifications would not reduce the New Haven's share of the annual cash loss of operating that facility. However, if the New Haven were required to pay these taxes on an annual basis, facilities change could produce a net cash gain to the New Haven of as much as $300,000. The point can also be made that the deficit actually understates the longer term picture because no provision is included for replacing passenger equipment.

2. Elimination of East End commuter service will reduce the New Haven's system passenger deficit by $700,000. This reduction may not be as great as anticipated however, because in calculating the East End deficit it was assumed that commuter revenue now collected on Boston-New York through trains would remain. In actual fact, probably some commuters would leave thereby reducing the revenue that was assumed could be applied against system costs.

3. Like the B&M, the New Haven could reduce its annual cash drain from passenger service during the first year of discontinuance. In developing this conclusion, avoidable costs were again classified as immediate (within thirty days), within one year, and after one year. Assuming that "within one year" items would be eliminated after nine months, first year losses would range from about $200,000 to $400,000 depending on the speed with which the thirty-day items could be eliminated. After the first year, the deficit would level off at about $100,000 until sale of the standard equipment eliminated it completely.

4. Fare increases of about 25 per cent would be needed to offset the current deficit. While this is lower than the more than 50 per cent increase required on the B&M, it would probably produce a drop in patronage and, hence, could not be expected to bring the East End commuter service to the break-even point.

C. General Findings

Development of the cost prediction model resulted in three general findings regarding cost variability.

1. Service levels requiring trick* coverage above that needed for minimum service incur heavy penalties in line semi-fixed costs. Minimum service requires two-trick coverage on weekdays only or a total of ten tricks per week. An additional trick across all lines (based on B&M figures) would mean about $35,000 annually in line semi-fixed costs for draw tenders, crossing tenders and towermen or a total of $125,000 for weekdays third trick coverage and $150,000 for weekend coverage.

2. Incremental service at higher volume levels becomes progressively cheaper because of the nature of corporate semi-fixed cost variability. These costs, which constitute more than a third of total expenses, do not vary directly with volume and produce a cost curve which rises rather sharply and then levels off. As a result, incremental costs at higher service levels are limited primarily to variable costs and hence, do not rise in proportion to volume. For example, a 77 per cent increase in service as measured by the number of trains operated from the pre-experimental to experiment levels required only 20 per cent increase in all cost.

3. The heavy proportion of total costs not directly assignable to individual lines (41 per cent) makes a local community support of commuter service difficult to establish on an equitable basis. To assist with this problem, allocation methods for all corporate fixed and semi-fixed costs have been included in the cost model. However, these methods are necessarily somewhat arbitrary and the percentage assigned to each line can change markedly depending on the makeup of the overall system.

*shift

Chapter Five

Bus Company Experiments

I. Negotiation of Carrier Contracts

A. General Background

As part of the process of preparing the material for the joint report of the Recess Committee and the MTC, the staff of the MTC systematically met with the organization of private bus company operators in the Commonwealth. At these meetings the cooperation of the private bus industry was solicited in the specification of the bus portion of the joint report, as well as in the preparation of the bus portion of what became the MTC's application for a mass transportation demonstration grant.

Through their Association, every private bus company in the Commonwealth was requested to submit to the Commission proposals for possible experiments, the results of which might be generally applicable to bus operations in similar urban areas throughout the country, and, in addition helpful in planning their own operations.

The Demonstration Project bus portion became finalized on the basis of an extensive program of evaluation of these proposals, eventually resulting in the specification of the experiments actually conducted. The experiments were selected not only on the basis that they would yield valuable data in the individual instance but also on the basis that they would clearly provide a broad range of operational and planning guide lines that might be applicable in other urban areas.

B. Contract Price

Preliminary studies by the staff and consultants to the MTC indicated that the average cost per bus mile of operation as reported to the state Department of Public Utilities was the most reasonable basis for the compensation to the individual carriers. The computation of such average costs is required by Massachusetts statute and DPU regulations and were the only authoritative uniform basis for contract negotiations available to the MTC.

In some individual instances this reported average cost per mile was reduced slightly in arriving at a contract price when, in the mutual judgment of the staff and consultants of the Commission and the carrier management, certain overhead costs included in the averaging would clearly not be increased as a result of the addition of experimental service. In one instance, the contract price was lower than average cost of the carrier because the experimental operation would be almost completely on express highways while the company's average cost was affected by its substantial operations in congested areas.

The cost studies of the individual companies conducted for the MTC by Systems Analysis and Research Corporation (SARC) indicate that most costs for the private bus industry in Massachusetts vary with the miles operated. Consequently, the selection of average costs and the basis for contractual compensation was proven generally sound.

The individual contract price per mile was felt to be the closest approximation that could be established for the actual

cost of the service improvements provided for in the bus carrier and MTA contracts. This did not, however, provide adequately for general overhead, return on investment, or "normal" profit, nor did it cover the additional costs of maintaining special records for Commission purposes. Consequently the MTC private bus and MTA contracts provided for retention by the carrier of 20 per cent of any new or additional revenue to compensate it for the costs that were not included in the per mile payment.

Preliminary studies of the bus industry in Massachusetts by the MTC staff had revealed that the individual companies (including the MTA) had minimal (if any) advertising budgets as part of their normal operating expenses. Consequently, separate provisions were made in bus company contracts, as in the rail contracts, for company advertising of the experimental service. Initially, the minimum requirement for advertising expense was set at one per cent of the gross cost of the service improvements. In later contracts the minimum was increased to two per cent.

1. Service Increases

Each bus company contract requiring either increased service on an established route, or the extension of established routes, or the establishment of a new route, provided for payment to the carrier for costs incurred on the basis of the average cost per mile as filed with the Department of Public Utilities, with certain exceptions as noted above.

Where the contract called for new service, 80% of the fare box revenue received and, where the contract called for extended or improved service, 80% of the revenue received above a base figure, was credited toward the reduction of the Commission's obligation to the carrier. In most cases the base figure was the revenue for the corresponding period in the year preceding the experimental period.

2. Fare Reductions

Two fare reduction experiments were conducted by the Eastern Massachusetts Street Railway Company for the Commission. In both instances a revenue base was established by an extensive negotiation between technical staff and consultants of the MTC and the management of the company, on the basis of revenue records of the company for the preceding and corresponding time periods. In both instances a contractual provision was made for a credit to the Commission if the fare box revenue exceeded the established revenue base during the experimental period.

C. MTC Monitoring of Carrier Performance

Each MTC contract with a bus company required the carrier to keep systematic records during the experimental period. Periodic regular reports were required of the carriers and these were reviewed by the MTC staff. In addition, the MTC developed a field staff as part of its Demonstration Project staff. These experienced field staff members actually rode the experimental lines, making field checks on the accuracy of the reports submitted and to insure that the level and quality of service performed by the company was in accord with the contractual provisions also conducted thorough audits of each of the bus companies, tracing through key segments of the financial records of the company in their determination of Commission obligations to the Company.

conducted audits of each individual carrier independently of the auditing activities of the MTC. In every instance the Commonwealth auditors' analysis corroborated the audits by the MTC staff. Federal auditors have also carried out similar work.

II. Suburban Service to Boston

A. Boston-Milford (The Short Line, Inc.)

1. Description

a. Physical Setting

The prior service, increased by this experiment, ran from Milford to Park Square in downtown Boston through the suburban communities of Medway, Millis and Medfield. Five-year old suburban type buses, in good condition, covered this 33 mile route in 90 minutes with a zone fare from 20¢ to $1.30. Over two-thirds of the passengers paid fares from 80¢ to $1.10.

Together these four communities all shared an open, suburban character, with low density land development, above average income, and little local employment. Their population in 1960 was: Milford 15,749, Medway 1,602, Millis 2,588 and Medfield 2,424.*

The only other public transportation service available to the residents of these communities is one train a day, each weekday, on the West Medway Branch of the New Haven Railroad. Standard, unlimited access, two-lane highways are the major routes available to the commuter traveling to Boston; private automobile travel time is only slightly less than that of the bus.

While the route traversed two towns nearer to Boston, Westwood and Dedham, service provided to these towns was limited to rapid transit feeder service since through passengers to downtown Boston were forbidden by the Department of Public Utilities in accordance with the pattern of protection of the MTA. Thus, these nearby towns are only an incidental part of the experimental pattern.

b. Purpose.

The purpose of this experiment was to test the effect on ridership of a substantially improved service increase on a bus line connecting several small suburban communities which did not have an alternative form of public transportation service to the downtown core. The low population

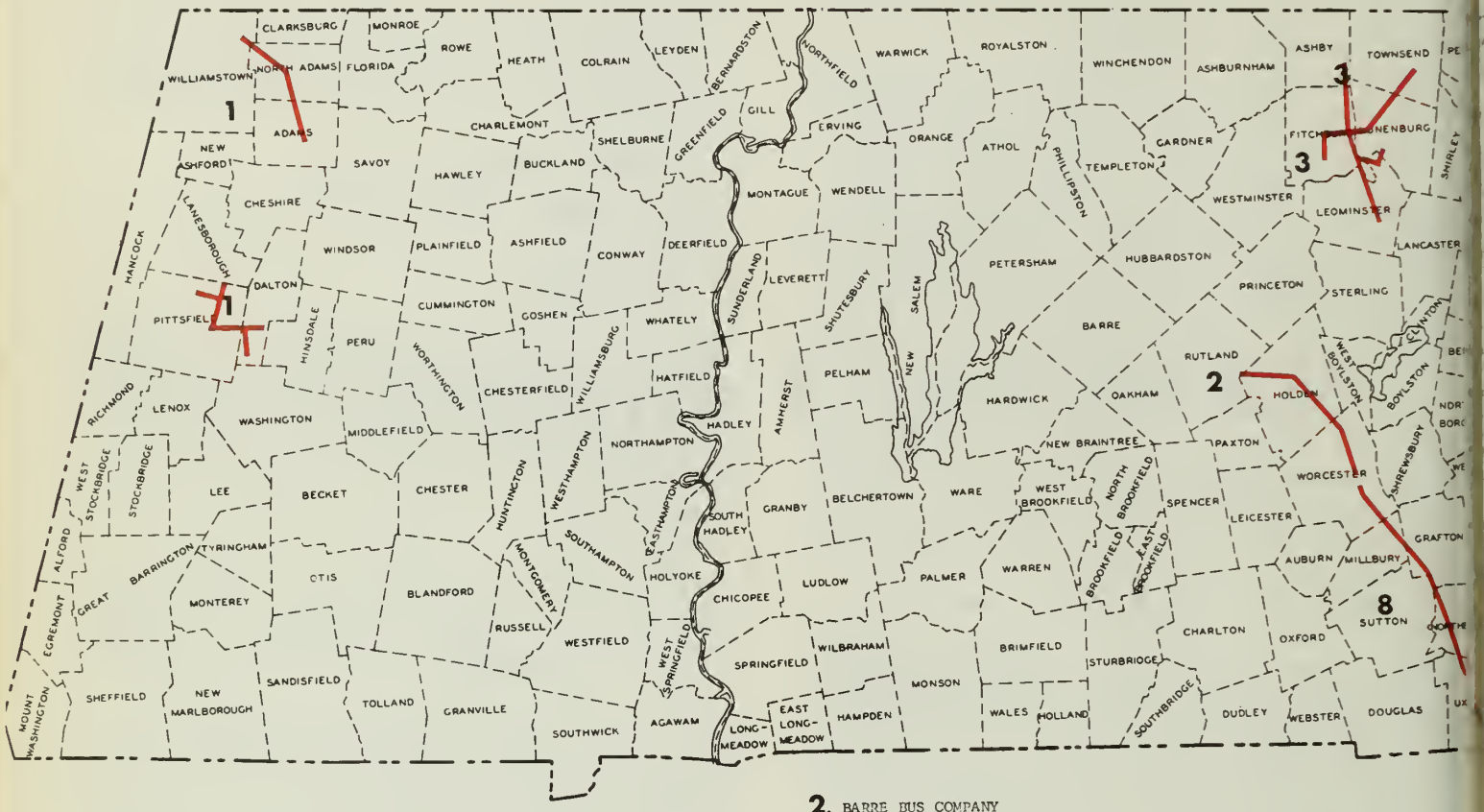
*The average family income in Massachusetts in 1960 was $6,272, according to the U.S. Census. Community population figures are those included in the U.S. Census tabulations for 1960.

1. YELLOW COACH COMPANY

a. New Service to Francis Plaza Housing for the Elderly, Pittsfield
b. Increased Service to Wahconah and Wilson Park Housing Developments, Pittsfield
c. Increased Service to Green Ridge Park Housing Development, Pittsfield
d. Increased Service between Adams, North Adams and Williamstown

3. FITCHBURG AND LEOMINSTER STREET RAILWAY COMPANY

a. New Service from downtown Fitchburg to the Fitchgate Shopping Cer
b. New Service from the Fitchburg Railroad Station to Lunenburg and Townsend
c. New Service from the Fitchburg Railroad Station to Ashby Center
d. New Service to Industrial plants
e. Increased Service between Fitchburg and Leominster
f. Extension of Fitchburg and Leominster route in Fitchburg



2. BARRE BUS COMPANY

a Increased Service from Rutland and Holden to Worcester

8. SHORT LINE, INC.

a. Increased Service - Milford to Boston
b. Increased Service - Worcester to Uxbridge

THE COMMONWEALTH OF MASSACHUSETTS

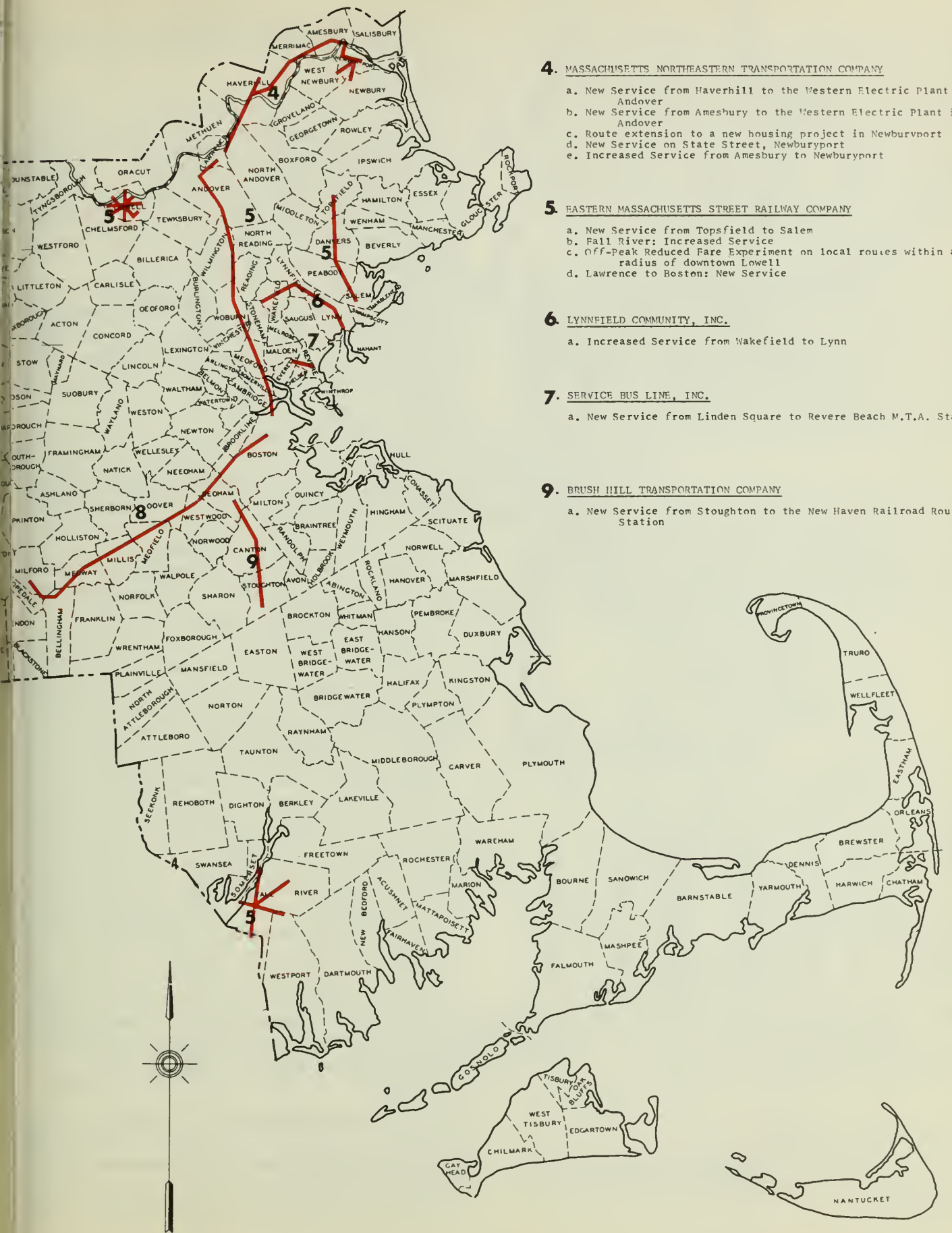
MASS TRANSPORTATION COMMISSION

BUS DEMONSTRATION PROJECTS

PROJECTS CONCLUDED

10 0 10 20 30 40

SCALE IN MILES



4. MASSACHUSETTS NORTHEASTERN TRANSPORTATION COMPANY

a. New Service from Haverhill to the Western Electric Plant in North Andover
b. New Service from Amesbury to the Western Electric Plant in North Andover
c. Route extension to a new housing project in Newburyport
d. New Service on State Street, Newburyport
e. Increased Service from Amesbury to Newburyport

5. EASTERN MASSACHUSETTS STREET RAILWAY COMPANY

a. New Service from Topsfield to Salem
b. Fall River: Increased Service
c. Off-Peak Reduced Fare Experiment on local routes within a $1\frac{1}{2}$ mile radius of downtown Lowell
d. Lawrence to Boston: New Service

6. LYNNFIELD COMMUNITY, INC.

a. Increased Service from Wakefield to Lynn

7. SERVICE BUS LINE, INC.

a. New Service from Linden Square to Revere Beach M.T.A. Station

9. BRUSH HILL TRANSPORTATION COMPANY

a. New Service from Stoughton to the New Haven Railroad Route 128 Station

density did not warrant a rapid transit extension or rail service, and therefore a secondary objective was to test whether such communities could sustain suburban bus service, the only remaining potentially viable form of public transportation service from these communities to the core.

Prior frequency of service was approximately every two hours throughout the business day from 8 a.m. to 7 p.m., (Boston arrival), with one additional evening trip. Saturday service was on a three hour frequency and on Sunday only three trips were provided.

c. Experimental Changes.

There was no fare change during the experiment, which began on January 2, 1963 and concluded on December 31, 1963. Weekday service was increased from 9 to 16 trips, resulting in hourly arrivals in Boston from 7 a.m. to 7 p.m., with two evening trips and one additional trip in each rush hour period. Saturday service was doubled from 7 to 14 trips, maintaining the hourly pattern. Sunday service was not changed during the experiment.

2. Results.

Service increase generated steady increases in passenger volume on this route. At the point on route of maximum impact of the experiment, average weekday inbound head counts increased from 209 in January to 275 in December. The additional revenue off-set the additional cost at the rate of 25% in the first month and rose to 50% in the twelfth month.

TABLE 38

MILFORD-BOSTON
(The Short Line, Inc.)

Period	Revenue 1963	Revenue 1962	Revenue Increase	Gross Contract Cost +	Rev. Increase/ Cost	Av. Weekday Inbound Passengers*
January	$ 9,851	$ 8,485	$ 1,366	$ 5,522	24.7	209
February	8,999	7,269	1,730	4,885	35.4	222
March	10,130	8,736	1,394	5,522	25.2	226
April	10,250	8,742	1,507	5,522	27.3	229
May	10,095	8,532	1,564	4,672	33.5	209
June	9,415	8,094	1,321	5,309	24.9	208
July	10,003	7,777	2,226	5,522	40.3	205
August	9,906	8,158	1,748	5,734	30.5	228
September	10,385	8,063	2,322	5,097	45.6	242
October	11,195	8,686	2,508	5,522	45.4	263
November	10,191	8,358	1,833	5,097	36.0	271
December	11,536	8,833	2,703	5,309	50.9	275
1/2/63 – 12/31/63	$121,956.	$99,733.	$22,224.	$63,712.	34.9	232

+ Basis: 45.968 cents per mile.
* Possenger Counts taken ot Boston-Dedham Line.

Source: Passengers: Drivers head counts; Revenue: Revenue Audits.

3. Post Experiment Results.

The Short Line, Inc. management retained nearly 40 per cent of the increased service after the termination of the experiment.

B. Reduced Fare North of Boston (Eastern Massachusetts Street Railway Company)

1. Description.

a. Physical Setting.

All communities north of Boston with common service by both the B&M Railroad and the Eastern Massachusetts Street Railway Company (all bus) were included in a reduced off-peak fare experiment. Both companies charged identical off-peak fares to downtown Boston from the following cities: Lowell, Lynn, Salem, Marblehead, Swampscott and Lawrence. (For Lawrence, see C. below).

The bus equipment used in this experiment was of the standard transit and suburban type, with an average age of five years and in excellent condition. (For a more detailed description of the "North Shore" area see Chapter Two of this report and the Supplement One, "The Boston Region").

b. Purpose

The purpose of this experiment was to eliminate differentials in fare from the competitive points served by both rail and bus in the off-peak period and to test the effects of such reduced off-peak equal fares on passenger volumes. Basically, the bus experiment was part of a control portion of the much larger B&M rail experiment.

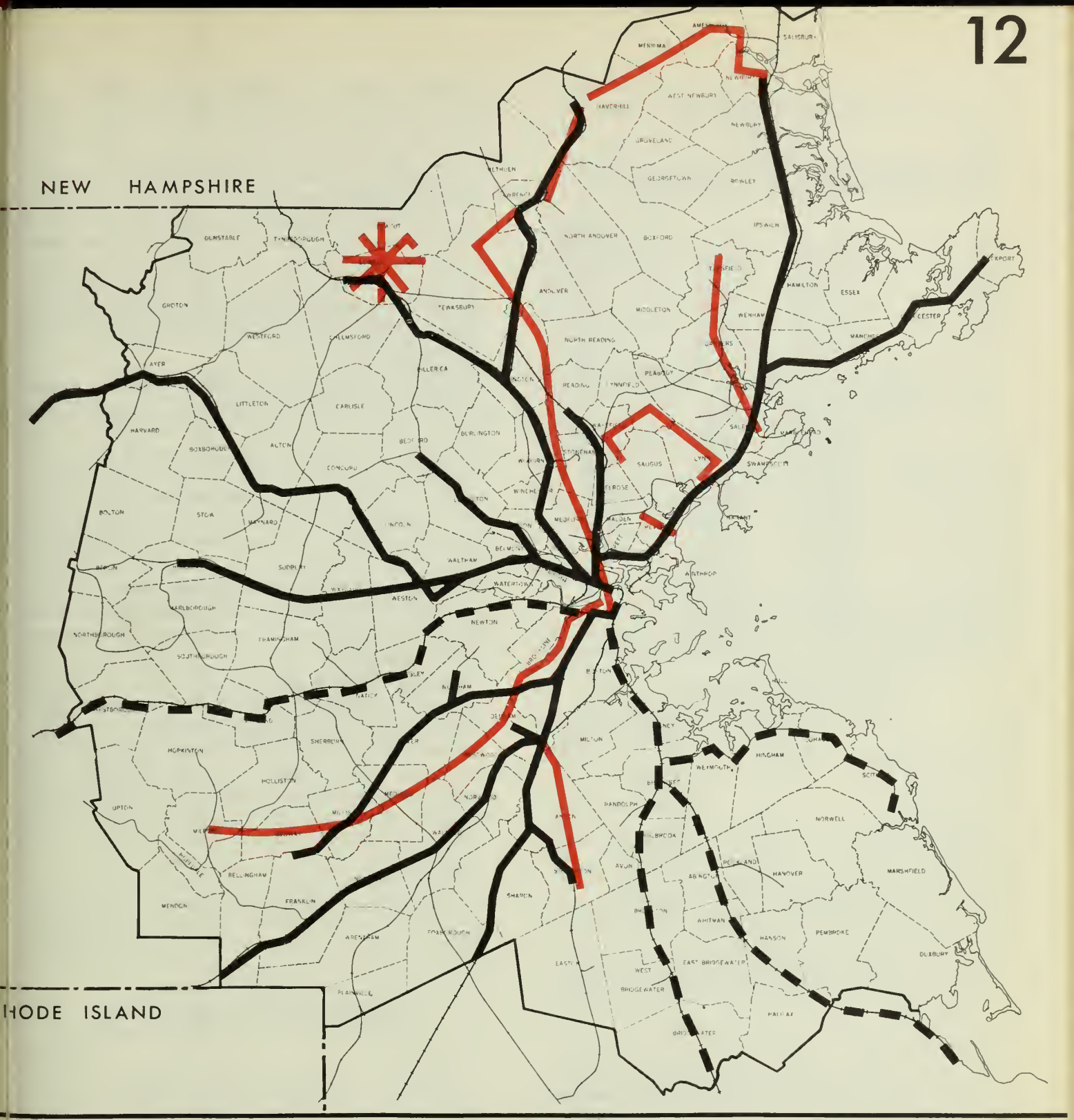
Rail and bus off-peak fares were made identical to remove the element of fare competition from passenger choice of public transportation mode.

c. Experimental changes.

The changes introduced by the experiment consisted of off-peak fare reductions only, in accord with the pattern described above in connection with the B&M experiment for an average fare reduction of approximately 30 per cent. Specification of an exact average fare reduction is impossible because of the great mixture of passenger volume from different points, the absence of correspondingly detailed records by the company, and the overlapping of fares. The experimental off-peak fare was applicable on all trips arriving in Boston after 9:30 a.m. and leaving before 4:30 p.m. or after 6:30 p.m. Monday through Friday. and all day Saturday and Sunday. The course of this experiment coincided with the second and third phases of the B&M experiment, beginning August 1, 1963 and concluding March 21, 1964. (There was a brief period from January 1 through January 11 when the experimental fare was maintained although the carrier received no compensation for this period, which was similar to the interval blanketing the end of phase two and beginning of phase three of the B&M experiment.)

2. Results.

The reduction in fares resulted in an increase in patronage for the bus company with the revenues actually reaching 96 per cent of the base figure during the month of December 1963. The characteristics of the passengers using this service during the experimental period are described in Chapter



BOSTON REGION RAIL AND BUS EXPERIMENTS

RAIL EXPERIMENT LINES

OTHER RAIL LINES

BUS EXPERIMENT ROUTES

Seven and delineated in some detail in the Fourth Supplement to this report prepared by Joseph Napolitan Associates.

TABLE 39

NORTH SHORE OFF-PEAK FARE REDUCTION EXPERIMENT
(Eastern Massachusetts Street Railway Company)

Period	1963 Revenue	Base Revenue*	1963 Revenue/ Base Revenue
August, 1963	$ 248,129	$280,224	25.5%
September	223,190	280,224	79.6
October	255,769	280,224	91.3
November	223,870	280,224	79.9
December	269,376	280,224	96.1
8/1–12/31/63	$1,220,334	$1,401,120	87.1%

*Monthly average of divisional revenues, January-June, 1963 reduced by 9.4% to reflect secular decline.

TEN WEEK EXTENSION

Period	1964 Revenue	Base Revenue*	1964 Revenue/ Base Revenue
Jan. 12-18, 1964	$ 60,656	$ 66,888	90.7%
Jan. 19-25	57,349	66,888	85.7
Jan. 26-Feb. 1	59,355	66,888	88.7
Feb. 2-8	58,952	66,888	88.1
Feb. 9-15	58,349	66,888	87.2
Feb. 16-22	61,836	66,888	92.4
Feb. 23-29	62,753	66,888	93.8
March 1-7	61,385	66,888	91.8
March 8-14	59,454	66,888	88.9
March 15-21	61,067	66,888	91.3
1/12–3/21/64	$601,156	$668,880	89.9

* Weekly average of divisional revenues for selected months of 1963, adjusted for secular trends.

PASSENGER VOLUME STATISTICS

Line	Inbound Passengers Per Day Mon.-Fri.	Saturday	Sunday
Lowell-Boston	231	288	90
Lowell-Everett Station	574	647	116
Lynn-Boston	1019	408	193
Salem-Boston † (Via Loring Avenue)	233	23	149
Salem-Boston † (Via Highland Avenue)	176	173	60
Marblehead-Boston	557	318	205
Reading-Everett Station	185	--	--
Melrose-Sullivan Square	15	--	--

† Route passes through Central Square, Lynn.
Source: Eastern Massachusetts Street Railway Company reports.

C. Lawrence-Boston Express Service (Eastern Massachusetts Street Railway Company)

1. Description.

a. Physical Setting.

This experiment connected two standard metropolitan statistical areas in the Boston region by new express bus service over high-speed interstate highways. The bus route is 30 miles from downtown Lawrence to downtown Boston with a running time of one hour. New suburban type bus equipment in excellent condition was used.

The MTC preliminary survey of the Boston Region (P-24) was based on a recognition of the interrelationship of the three SMSA's surrounding Boston (Brockton, Lowell, Lawrence) with the Boston SMSA. This historical interrelationship of Boston and Lowell was intensified in the post-war geographic expansion of housing, highways, industrial development and retailing. Presently, the distinction of urban zones of influence is disappearing, as the Boston SMSA expands in all directions and the Lawrence SMSA expands south. SMSA's surrounding Boston are tending to become "suburban" SMSA's. As these areas come closer and as the economic ties increase, the market potential for all forms of public transportation appears to increase. This experiment provided an opportunity to measure the utility of new public transportation made possible by post-war superhighways between two SMSA's in the same urban region while also measuring the relative acceptability of parallel public transportation modes.

Public transportation between these two SMSA's was also provided by the B&M. Rail frequency consisted of hourly service, with additional service in the rush hour, on a running time of 35 minutes. While the running time for the express bus service was one hour from downtown Lawrence to downtown Boston, the bus was competitive with the B&M service because both rail terminals were less conveniently located for shopping and major downtown employment areas.

The experiment provided new service at a one-way unrestricted fare of $1.00, and an off-peak fare of 65¢ to correspond to the off-peak fare experiment described above. The entire experiment ran from August 19, 1963 through February 15, 1964.

Prior bus service from Lawrence to Boston was available but only by a local bus service over a circuitous route to Everett Station in Everett requiring a change to the MTA to reach downtown Boston and a single peak hour trip to Haymarket Square. Total trip time for this service, prior to this experiment, was approximately two hours. The prior bus-rapid transit service was therefore in no way comparable to the experimental service.

b. Purpose.

The purpose of this experiment was to measure the response to new express bus service from one small urban center to the core of the greater urban region, on high speed

TABLE 40

LAWRENCE-BOSTON EXPRESSWAY SERVICE
(Eastern Massachusetts Street Railway Company)

Period	Revenue	Gross Contract Cost +	Revenue/ Cost	Av. Weekday Inbound Passengers
August 19-31, 1963	$ 721.70	$ 4,026.00	17.9%	46
September	1,580.97	8,052.00	19.6	46
October	2,165.22	9,058.50	23.9	54
November	2,236.48	8,723.00	25.6	62
December	2,408.00	8,723.00	27.6	62
January, 1964	3,103.23	9,058.50	34.3	77
February 1-15	1,859.70	4,422.50	42.1	83
8/19/63 – 2/15/64	$14,075.30	$52,063.50	27.0	61

+ Basis: 50.0 cents per mile.

Source: Eastern Massachusetts Street Railway records.

interstate highways in competition with commuter railroad service.

2. Results.

The average weekday one-way passenger count rose from 46 in the first week to 83 in the final week of the experiment. The revenue cost ratio increased in a steadily upward growth, reaching 42 per cent.

3. Post Experiment Results.

The carrier maintained more than 40 per cent of the experimental service at the conclusion of the experiment, modifying the schedule according to the ridership patterns established during the experiment. By mid-April, 1964, the carrier had re-established some of the trips discontinued at the conclusion of the experiment.

III. Suburban Service to Small Urban Areas

A. Uxbridge-Worcester (The Short Line, Inc.)

1. Description.

a. Physical Setting.

The prior service from Uxbridge to Worcester through Northbridge and Millbury was a 17-mile route, with a running time of 40 minutes. Service was every two hours during weekdays and every three hours on Saturday; there were four trips on Sunday. While the fares were based on a zone system and ranged from 25¢ to 80¢, over four-fifths paid the full 80¢ fare. Equipment used on this line was the suburban and intercity type, only four years old, and in good condition.

The 1960 population of the three communities was as follows: Uxbridge, 7,789; Northbridge, 10,800; Millbury, 9,623. These towns are open and suburban in character, with low density land development, average incomes and limited local employment. Worcester (population 186,587) is the regional center for services, employment and shopping.

b. Purpose.

The purpose of this experiment was to measure the effect of more service through a group of small suburban communities to a metropolitan center.

c. Experimental changes.

During the experiment (July 16, 1963 to March 28, 1964), service was increased to provide hourly service during weekdays and Saturdays. There were no service increases on Sunday. There were no fare changes.

2. Results.

This experiment generated a moderate and steady growth in ridership from an average of 90 inbound weekday passengers in the first month of the experiment (July 1963) to 132 in the last month of the experiment (March 1964). The increased revenue covered 30 per cent of the incremental (contract) cost of the new service.

TABLE 41

UXBRIDGE-WORCESTER
(The Short Line, Inc)

Period	Revenue 1963	Revenue 1962	Rev. Increase/	Gross Contract Cost +	Rev. Increase/ Cost	Av.* Weekday Inbound Passengers
1963						
July 15-31	$ 2,413.	$ 2,504.	$ (91)	$ 1,687.	(5.4)%	90
August	5,582.	5,991.	(139)	3,008.	(4.6)	98
September	5,480.	5,007.	473	2,683.	17.6	102
October	5,316.	5,070.	246	2,935.	8.4	108
November	5,206.	5,040.	166	2,662.	6.3	114
December	5,568.	5,785.	(217)	2,798.	(7.7)	124
1964						
January	5,249.	4,789.	460	2,914.	15.8	114
February	5,461.	4,368.	1,093	2,777.	39.4	119
March 1-28	5,528.	4,887.	641	2,170.	29.5	132
7/15/63 – 3/28/64	$45,803.	$43,441.	$2,362	$23,635.	9.9%	111

* Average daily Drivers' count of number of passengers on board all buses operating between Providence and Worcester as the bus crosses the Worcester City Line.

\+ Basis: 45.968 cents per mile.

3. Post Experiment Results.

As a result of the experiment, approximately one-third of the increased service was retained by the company over the same route with the same fares.

B. Adams-North Adams-Williamstown (Berkshire Street Railway Company and Yellow Coach Lines, Inc.)*

1. Description.

a. Physical Setting.

The prior service increased by this experiment ran from Adams through North Adams to Williamstown. The route was 13 miles in length and the scheduled running time was 25 minutes. This service accommodated student and local traffic to the shopping areas of North Adams and also provided interconnecting bus service to Pittsfield, the major shopping area in the western portion of the Commonwealth. Pittsfield has a population of 57,879 and is the regional center for employment, retailing and services.

Adams (population 12,391) is primarily a manufacturing town with two large paper companies and large fabric finishing firms. North Adams (population 19,905) is closely linked industrially with Adams and serves as the principal shopping center for the area. Williamstown (population 7,322) is a picturesque college town with the population increasing by 2,000 when Williams College is in session.

Together these three low density communities function as one urban area, although clearly well below the magnitude of an SMSA.

*This experiment was undertaken by two carriers. See explanation below.

Prior to the experiment the Berkshire Street Railway Company provided 14 round-trips daily from Adams to Williamstown, with no service on Sunday. The fares were based on a zone system with a range from 25¢ to 60¢.

Both companies used the transit type of equipment, but the Berkshire Street Railway Company equipment was 20 years old and in poor condition, while the Yellow Coach equipment was 10 years old and in good condition.

b. Purpose.

The purpose of this experiment was to measure the effect on ridership of substantially improved service on a route connecting three comparatively small but interrelated urban communities.

c. Experimental Changes.

Service was increased from 14 to 24 round-trips daily (no service on Sunday), providing better than hourly frequency. The Berkshire Street Railway Company maintained this service from March 11, 1963 through May 31, 1963, when the Commission terminated the Berkshire contract for non-performance (shortly thereafter the Berkshire Street Railway Company, which had been having considerable financial and operational difficulties, entered bankruptcy and ceased operating all together). To ensure continuity of the experiment, the Commission entered into a new contract with Yellow Coach Lines, Inc. to maintain the service with a minimum interruption of only a few days. The Yellow Coach contractual service began on June 7, 1963.

There were no fare changes throughout this experiment, which concluded on August 15, 1963.

2. Results.

There were substantial increases in passenger volume from March 11 through May when the operational and financial difficulties of the Berkshire Street Railway Company temporarily disrupted the service pattern and reduced the entire bus service into unreliable status in the eyes of the public. After Yellow Coach resumed operations for the Commission, passenger volume again increased, but not to the extent reached in the first portion of the experiment. It should be noted that the Yellow Coach operation coincided with the summer vacation period when most of the Williams College students were not in the community.

The incremental revenue during the month of May actually surpassed the incremental cost as established by the contract price, with a corresponding credit to the Commission resulting in a reduction of the Commission's total obligations to the Berkshire Street Railway Company. The ratio of incremental revenue to incremental (contract) cost varied under Berkshire operations from 79 per cent to 147 per cent. It was 26 per cent in July and 53 per cent in August during the Yellow Coach operations. Overall, nearly 50 per cent of the incremental costs were met by the incremental revenue.

TABLE 42

ADAMS-WILLIAMSTOWN VIA NORTH ADAMS
(Berkshire Street Railway Company and
Yellow Coach Lines, Inc.)
Service Increase

Period	Revenue 1963	Revenue 1962	Increase	Gross Contract Cost	Rev. Incr. Cost*	Av. Weekday Inbound Passengers
March 11-31	$ 4,740	$ 2,889	$1,851	$ 2,338	79.2%	330
April	6,230	3,989	2,241	2,842	18.9	320
May	5,154	3,996	1,158	788	146.9	720
June 7-30	2,670	3,420	(150)	2,364	(31.7)	170
July	4,599	3,793	806	3,089	26.1	220
August 1-15	2,675	1,909	766	1,426	53.7	280
3/11–3/15/63						
3/15/63	$26,068	$19,997	$6,072	$12,847	47.3%	300

* Basis: 3/11–5/31: 49.207 cents per mile (Operated by Berkshire); 6/7–8/15/63: 45 cents per mile (Operated by Yellow Coach Lines, Inc.)

3. Post Experiment Results.

The Yellow Coach Lines maintained approximately 40 per cent of the additional service after the conclusion of the experiment.

C. Worcester-Rutland (Barre Bus Line, Inc.)

1. Description.

a. Physical Setting.

The service operated prior to this experiment ran from Rutland through Holden to Worcester for a trip length of 15 miles and a scheduled running time of 45 minutes.

Rutland (3,253) and Holden (10,117) are two small suburban communities with very low densities of population, almost completely dependent on the core city of Worcester for shopping, employment and other services. No express or superhighways exist between these communities and downtown Worcester.

The Barre Bus Line, Inc. is one of the smallest private bus companies in the United States, consisting of the owner-driver and one other employee. The equipment was of the transit type and was in fair condition for its 22 years of age. Prior service consisted of 9 round-trips per day, excluding Sunday. Fares were established on a zone fare system, varying from 20¢ to 60¢.

b. Purpose.

The purpose of this experiment was to measure the effects of increases in suburban bus service from two small communities to the core of the metropolitan area.

c. Experimental Changes.

Service was increased from 9 round-trips daily to 12 round-trips daily. The experiment began July 1, 1963 and was concluded February 29, 1964.

2. Results.

No established pattern of revenue increase to basic con-

tract costs appeared during the course of the experiment. The results were decidedly erratic, possibly because of the closing of two manufacturing plants in the Worcester area which had formerly provided many passengers for this line. While a relationship undoubtedly existed between the pattern of ridership and the changing level of industrial activity in the area, the quantitative nature of this relationship could not be established during the course of this experiment.

TABLE 43

RUTLAND–WORCESTER SERVICE INCREASE
(Barre Bus Line, Inc.)

Period	Revenue 1963 †	Revenue 1962	Increase	Contract Cost††	Rev. Incr./ Cost	Av.* Weekday Inbound Passengers
July 1-27	$1,026	$ 911	$ 114	$515	22.2%	145
July 29-Aug. 31	1,394	1,109	285	672	42.4	155
Sept. 3-28	1,092	1,026	66	515	12.8	158
Sept. 30-Oct. 26	1,249	896	353	515	68.4	188
Oct. 28-Nov. 30	1,604	1,271	334	605	55.1	184
Dec. 2-28	1,280	1,107	173	515	33.5	227
Dec. 30-Feb. 1	1,090	1,282	(192)	605	(31.8)	175
Feb. 3-29	864	1,100	(236)	515	(45.7)	184
7/1/63 – 2/29/64	$9,600.	$8,704.	$ 897.	$4,460.	20.1%	176

† Fores were increased approximately 15% on April 7, 1963.
†† Basis: 24.9 cents per mile.
* Covering Saturdays as well as weekdays.

D. Fitchburg to Lunenburg, Townsend and Ashby (Fitchburg and Leominster Street Railway Company)

1. Description.

a. Physical setting.

The communities joined by this new service included the city of Fitchburg and the suburban towns of Lunenburg, Townsend and Ashby. The new service consisted of two separate runs operated in an integrated fashion to make more efficient use of equipment and manpower.

Fitchburg is a city of 43.021 population and is the urban center of the Fitchburg-Leominster SMSA. The metropolitan area has a total population of 82,486. Lunenburg, Townsend and Ashby are very low density suburban communities with populations of 6,334, 1,101 and 1,833, respectively. While these communities are linked by fairly good roads, there are no express or superhighways.

The Fitchburg and Leominster Street Railway Company is one of the better managed private operations in Massachusetts. The equipment utilized in this operation was of the transit type, in good condition and with an average age between 8 and 10 years.

b. Purpose.

The purpose of this experiment was to test the effect of new service between a medium sized core city of a smaller SMSA and the light density residential suburban communities.

c. Experimental Changes.

Five new trips in each direction daily except Sunday at a day-time frequency tailored to the commuter work and suburban-downtown shopping travel patterns of the area, were provided at a zone fare ranging from 20¢ to 60¢. The length of the trip was 16 miles in each direction between Fitchburg and Lunenburg and Townsend, with a scheduled running time of 30 minutes, and 8 miles between Fitchburg and Ashby with a scheduled running time of 20 minutes. The experimental period was March 11, 1963 through August 31, 1963. There were no fare changes.

2. Results.

The inbound passenger count did not vary substantially between the first and final month of the experiment. Similarly, the new revenue fluctuated between 10 and 13 per cent of the total contract cost.

TABLE 44

FITCHBURG TO LUNENBURG, TOWNSEND, AND ASHBY – NEW SERVICE
(Fitchburg and Leominster Street Railway Company)

Period	Revenue	Gross Contract Cost †	Revenue Cost	Av. Weekday Inbound Passengers
Morch 11-31, 1963	$ 311	$ 2,441	12.7%	28
April	493	3,526	14.0	31
Moy	456	3,526	12.9	31
June	366	3,390	10.8	26
July	412	3,526	11.7	29
August	375	3,661	10.2	25
3/11-8/31/63	$2,413	$20,070	12.0%	28

† Basis: 48.259 cents per mile.

IV. Feeder Service

A. Malden-Revere (Service Bus Lines, Inc.)

1. Description.

a. Physical Setting.

This new service linked a densely populated highly urbanized area with the terminal of the MTA rapid transit line providing direct and speedy service to the downtown portion of the Boston region. Good five year old transit type equipment was used for this experiment.

b. Purpose.

The purpose of this experiment was to test the response to new feeder service from a heavily urbanized densely populated area to a rapid transit terminal.

c. Experimental Changes.

The experiment started on December 17, 1962 and was concluded on November 15, 1963. The new service on the 3 mile route consisted of 24 round-trips weekdays and 20 round-trips Saturday with no service on Sunday. A basic pattern of one-half hour frequency was established with the first and last trips deleted from the Saturday service. Running time was 15 minutes and the fare was 10¢.

2. Results.

Apart from the usual seasonal summer decline there was a steady growth of average weekday inbound passengers from 155 in the month of December, 1962 to 208 in November, 1963. Similarly, the revenue increased from 46 per cent to 75 per cent of the cost of service from the first to the final month.

TABLE 45

LINDEN–REVERE
(Service Bus Lines, Inc.)

Period	Revenue*	Grass Contract Cost†	Revenue/ Cost	Av. Weekday Inbound Passengers††
Dec. 17-31, 1962	$ 643	$ 1,394	46.1%	155
Jan. 17-Feb. 16	872	1,499	58.2	170
Feb. 17-March 16	784	1,280	61.2	160
March 17-April 16	953	1,452	65.7	180
April 17-May 16	974	1,452	67.1	180
May 17-June 16	930	1,385	67.2	205
June 17-July 16	883	1,394	63.3	222
July 17-Aug. 16	978	1,509	64.8	186
Aug. 17-Sept. 16	910	1,442	63.1	188
Sept. 17-Oct. 16	$ 1,074	1,404	76.5	207
Oct. 17-Nov. 16	1,085	1,442	75.2	218
12/17/62–11/16/63	$10,085	$15,654	64.4%	193
Post-Experiment				
Nov. 18-30, 1963				184
Dec.				186
Jan., 1964				191
Feb.				195
March				190
				189

*No 1962 figures - new service.

† Basis: 39.795 cents per mile.

†† Counts based on fares collected. Under the experiment, children and students were counted as one-half passenger each, since they paid one-half the 10¢ adult fare. Similarly, children and students have been recorded as two-thirds passenger each since the experiment ended and the adult fare was increased to 15¢.

3. Post Experimental Results.

The operator increased the fare from 10¢ to 15¢ and maintained all the experimental service. While there was a slight decline in post experimental passenger counts, the operator is now providing the same service at a slight profit.

B. Topsfield-Salem (Eastern Massachusetts Street Railway Company)

1. Description.

a. Physical Setting.

This new feeder service linked the Boston suburban community of Topsfield (3,351) with Salem (39,211), from which good railroad commuter service was available to the downtown Boston area.

Topsfield is a low density, high income suburban community without any previous direct public transportation service to the regional downtown core. There is a high speed divided highway between Topsfield and Boston which provided excellent automobile transportation facilities.

The equipment utilized in this 11 mile route was of the transit type, 2 years of age and in excellent condition. The scheduled running time was 25 minutes. The bus schedule was coordinated with the train schedule to provide for maximum commuter and shopper convenience.

b. Purpose.

The purpose of this experiment was to test the effect of new bus feeder service from a small, light density and above average income suburban community to a railroad station at which integrated rail service was available.

c. Experimental Changes.

Hourly service between the hours of 7:30 a.m. and 9:00 p.m. was provided at a fare of 50¢. The experiment began June 24, 1963 and was concluded on November 15, 1963.

2. Results.

Only minor variations in the number of average weekday riders developed throughout the course of the experiment, with the average being 4 in the first month (June), 9 in the peak month of October and 7 in the last two weeks of the experiment (the first two weeks in November). The revenue never reached 6 per cent of the incremental cost as determined by the contract price.

TABLE 46

TOPSFIELD–SALEM
(Eastern Massachusetts Street Railway Company).

Period	Revenue	Grass Contract Cost†	Revenue/ Cost	Av. Weekday Inbound Passengers
June 24-30	$ 16.00	$ 824.50	1.9%	4
July	89.25	3,627.80	2.5	4
August	97.25	3,606.60	2.7	4
Sept.	73.75	3,298.00	2.2	4
Oct.	210.00	3,792.70	5.5	9
Nov. 1-15	65.00	1,649.00	3.9	7
6/24–11/15/63	$551.25	$16,798.60	3.3%	11

† Basis: 50.0 cents per mile.

C. Wakefield-Lynn (Lynnfield Community, Inc.)

1. Description.

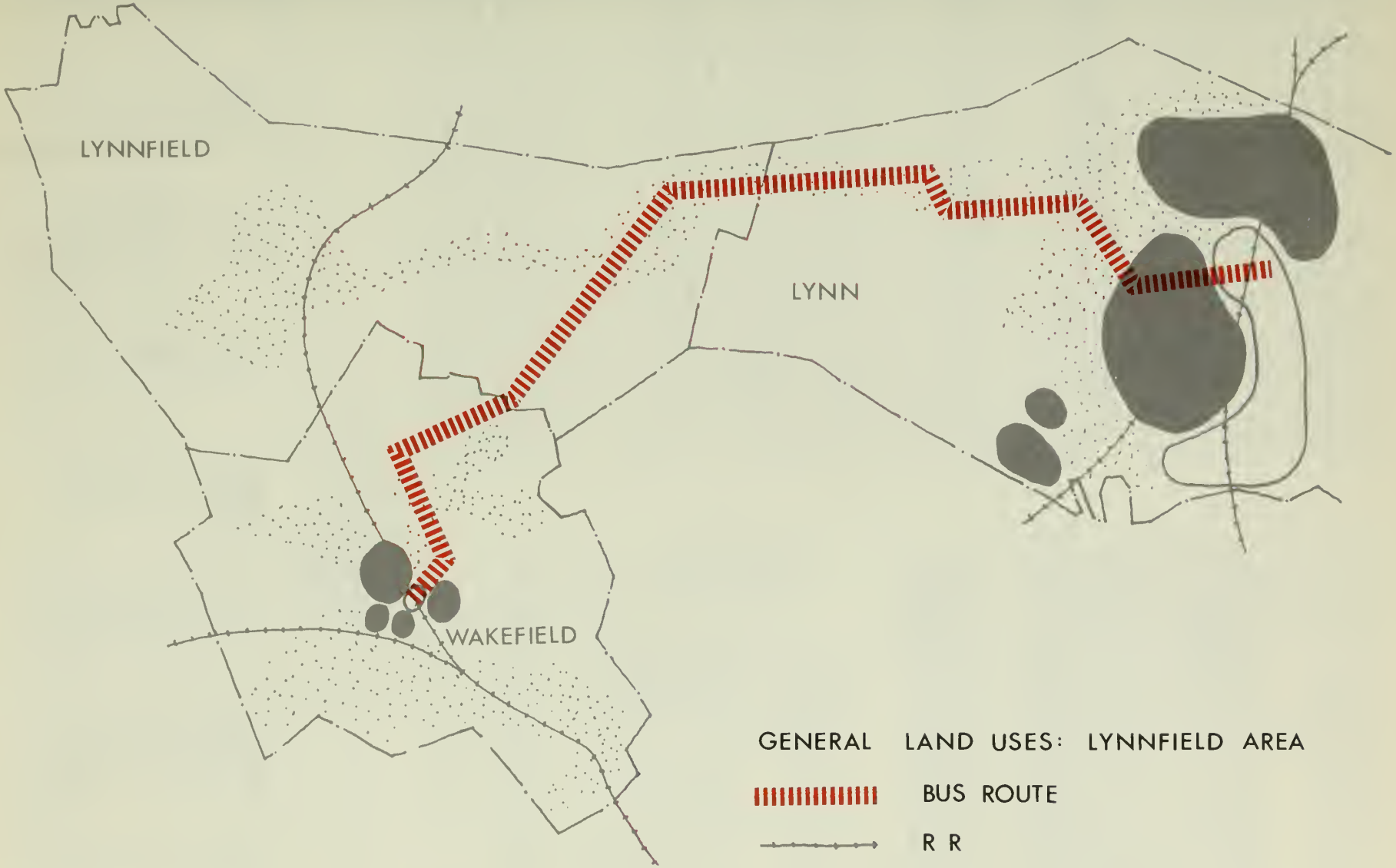
a. Physical Setting.

The two rail stations of Wakefield and Lynn, and the intervening community of Lynnfield, were connected by the bus service that existed prior to the experiment.

Lynn (population 94,478) is an old established industrial community while Wakefield (population 24,295) is a community of rapid growth both in population and in local economic activity. Lynnfield (population 8,398) lies between Wakefield and Lynn and is a very low density, high income suburban community.

The bus route was 10 miles long with a scheduled running time of 35 minutes. While the transit type buses used were 20 years of age, they were in fair to good condition.

Prior service provided a 30 minute headway in peak and a 60 minute headway in the off-peak period during the week,


LYNNFIELD
LYNN
WAKEFIELD
GENERAL LAND USES: LYNNFIELD AREA
BUS ROUTE
R R
SINGLE FAMILY
MULTI FAMILY
NON RESIDENTIAL

with two hour frequency on Saturday and no service on Sunday. The fare ranged from 25¢ to 40¢.

b. Purpose.

The purpose of the experiment was to measure the effectiveness of increased service on an inter-community feeder bus line serving two rail stations and an intervening low density, above average income residential community.

c. Experimental Changes.

Six trips were added to the 13 previously scheduled, to provide a one hour frequency between 7 a.m. and 11 p.m., Monday through Saturday; no service was provided on Sunday. The fare was not changed. The experiment began January 14, 1963 and concluded March 22, 1963.

2. Results.

No appreciable change in passenger counts developed during the course of this experiment. The ratio of incremental revenue to contract cost declined from 20 per cent in January to 12 per cent in March.

TABLE 47

WAKEFIELD TO LYNN THROUGH LYNNFIELD
(Lynnfield Community, Inc.)

Period 1963	Revenue 1963	Revenue 1962	Revenue Increase	Contract Cost †	Rev. Incr./ Cost	Av. Weekday Inbound Passengers
January 14-31	$1,906	$1,734	$172	$ 872	19.7%	200
February	2,801	2,666	135	1,312	10.3	320
March 1-23	2,288	2,170	118	1,024	11.5	275
	$6,995	$6,570	$425	$3,208	13.2%	265

† Basis: 44.107 cents per mile.

D. Stoughton-Route No. 128 New Haven Railroad Station (Brush Hill Transportation Company, Inc.)

1. Description.

a. Physical Setting

This experimental service provided new feeder bus service to the New Haven Railroad station at Route 128 from the community of Stoughton. The town of Stoughton, whose population increased from 13,750 in 1955 to 16,330 in 1960, is served by a branch line of the New Haven Railroad, with passenger service consisting of only two trains to Boston in the morning and two trains to Stoughton at night. While the experimental route traversed a part of Canton, the location of the route prevented the service from being of any great use to this community.

During the day, public transportation service was also provided hourly on the hour by the Brush Hill Transportation Company which carried passengers to an MTA rapid transit station at Mattapan.

Stoughton has excellent highway facilities to the fringe of the core area where the normal traffic congestion occurs in peak periods.

b. Purpose.

The purpose of this experiment was to test the results of the provision of new bus feeder service from what was essentially a commuting community to a railroad station where frequent railroad service to the core of the downtown area was available.

A secondary purpose was to test the acceptability of such a feeder service to main line rail service as an alternative to the eventual discontinuance of branch line railroad passenger service.

c. Experimental Changes.

New service provided 12 trips Monday-Friday and 9 on Saturday, with no service on Sunday. The length of the trip was 11.3 miles with a scheduled running time of 25 minutes and zoned fares varying from 15¢ to 30¢. Nine year old transit equipment in good condition was used. The experiment began April 22, 1963 and concluded November 2, 1963.

TABLE 48

STOUGHTON–ROUTE 128
(Brush Hill Transportation Co.)
Stoughton Feeder Services.

Period	1963 Revenue Canton (rail)	1963 Revenue Mattapan (MTA)	1963 Revenue Total	1962 Rev. Mattapan (MTA)	Revenue Increase	Gross Contract Cost	Revenue Increase Cost	Average Weekday Inbound Passengers
April 22-30	$ 11.	$ 815.	$ 827.	$ 897.	$(70.)	$ 736.	(9.5)%	3
May	60.	2,874.	2,934.	2,830.	104.	2,376.	4.4	5
June	67.	2,714.	2,781.	2,857.	(76.)	2,261.	(3.4)	6
July	83.	2,611.	2,694.	2,754.	(60.)	2,376.	(2.5)	8
August	94.	2,943.	3,037.	2,848.	189.	2,450.	7.7	10
Sept.	63.	2,522.	2,585.	2,513.	72.	2,187.	3.3	7
Oct. 1-Nov. 2	81.	2,908.	2,989.	2,905.	84.	2,565.	3.3	7
	$459.	$17,387.	$17,847.	$17,064.	$243.	$14,951.	1.6	7

Note: Revenue to cost ratio determined by total revenue increase, since the Canton-128 route offered a possible diversion of passengers from Mattapan.

† Basis: 35.0 cents per mile.

For contractual purposes, revenue from the bus service to both the railroad terminal at Route 128 and the MTA rapid transit terminal at Mattapan were measured as a unit against the corresponding revenue from the Stoughton-Mattapan service for the previous year.

2. Results.

The average weekday inbound passenger count varied from a low of 3 in the first week of the experiment to the high of 10 in the month of August. Correspondingly, the incremental revenue never reached 8 per cent of the incremental (contract) costs.

E. Amesbury-Newburyport-State Street Extension (Massachusetts Northeastern Transportation Company)

1. Description

a. Physical Setting

Amesbury (10,787) and Newburyport (14,004) are two old Massachusetts communities whose population actually declined between 1950 and 1960. Amesbury is an industrial town with substantial local employment; Newburyport is a manufacturing city (electrical machinery and shoe and leather industry). Historically both of these communities have contributed commuters to Boston.

The Massachusetts Northeastern Transportation Company had experienced sub-marginal operations for several years. Its transit and suburban type equipment was all in poor condition with an average age between 20-25 years. The MTC staff discovered a noticeable lack of community awareness of the existence of the local service provided by this company. The equipment was frequently poorly marked. Equipment breakdowns and consequent cancellations of trips were continually disrupting the service patterns.

Prior to the experiment the company scheduled hourly peak service and off-peak service every two hours on weekdays, for a total of 12 daily trips. Service was scheduled every two hours on Saturday but no service was provided on Sunday. Fares were zoned from 20¢ to 40¢. The length of the Amesbury-Newburyport route was 10 miles, with a scheduled running time of 20 minutes.

b. Purpose.

The purpose was to test the effect of increased bus feeder service to a rail station from a small suburban area.

A secondary purpose was to test the effect of new local service in the older urban area.

c. Experimental changes.

Eight trips were added to the previously scheduled 12 to provide for half-hour frequency in peak periods and hourly frequency in the off-peak. The bus schedule was coordinated with the experimentally improved direct rail service operating between Newburyport and downtown Boston. The experiment began March 11, 1963 and concluded October 19, 1963. Almost as a by-product because of availability of equipment and manpower, additional new local service was also established, consisting of 13 trips providing one hour frequency at 25¢ on a 1 mile route along State Street, the main street of Newburyport.

2. Results.

Revenue was kept on a combined basis for both the feeder service and the local service, operated with the same equipment. MTC staff interviews of the passengers on the new feeder service indicated that most were making a local trip to Newburyport from Amesbury and very few were actually using the service to transfer to the rail facilities.

The revenue gained as a result of the experiment varied between 11 per cent of the incremental (contract) costs in the first month of March to a high of 26 per cent in May, leveling off at 15 per cent in the final month of October.

TABLE 49

AMESBURY-NEWBURYPORT MAIN LINE SERVICE INCREASE AND NEW SERVICE ALONG STATE STREET, NEWBURYPORT. (Massachusetts Northeastern Transportation Company)

Period	Revenue 1963	Revenue 1962	Revenue Increase	Contract Cost †	Rev./ Rev. Cost	Av. Weekday Inbound Passengers
Morch 11-31	$ 888	$ 793	$ 95	$ 833	11.4%	N.A.
April	1,584	1,319	265	1,209	22.0	75
Moy	1,601	1,282	319	1,209	26.4	105
June	1,504	1,271	233	1,143	20.4	110
July	1,304	1,110	194	1,209	16.1	80
August	1,558	1,233	325	1,241	26.2	81
Sept. ††	1,363	1,181	183	801	22.8	80
Oct. 1-19 ††	850	756	84	555	15.2	70
	$10,654	$8,955	$1,700	$8,200	20.7%	85

† Bosis: 46.275 cents per mile.
†† State Street Service discontinued August 31st. Figures reflect operotion of increased Moin Line service only.

V. Local Service in Small Urban Areas

A. Pittsfield: Park Square-Green Ridge Housing Development (Berkshire Street Railway Company-Yellow Coach Lines, Inc.)

1. Description.

a. Physical Setting.

This experimentally increased local service took place completely within the city limits of Pittsfield. Pittsfield has a population of 57,879 and is the core city of the Pittsfield SMSA with a total population of 73,829. The length of the route was 3.3 miles with a scheduled running time of 15 minutes and a fare of 25¢. The Berkshire Street Railway Company provided all its local service with 20 year old transit type equipment in relatively poor condition. Yellow Coach Lines used 10 year old transit type equipment in fair to good condition.

The pre-experimental level of service consisted of three round-trips, Monday-Saturday, with no service on Sunday.

Park Square is the focal point of downtown activity. The other terminal of this line was the Green Ridge Housing

Development, an apartment development of 99 units for families with above average income. The area traversed by this route was residential, consisting primarily of private homes and three story multiple dwellings.

b. Purpose.

The purpose of this experiment was to measure the effects of increasing the frequency of local bus service in the more densely populated sections of the core city of a small SMSA.

c. Experimental Changes.

The number of round-trips was increased from three to eight daily, except Sunday when no service was provided. There was no change in fare.

The Berkshire Street Railway Company began the operation of this experimental service on March 11, 1963, but the Commission terminated this contract with Berkshire effective May 31, 1963 for non-performance. Yellow Coach Lines then operated the service under contract with the Commission from June 7, 1963 to January 15, 1964, when the experiment was completed.

2. Results

Possibly because of the difficulties of the Berkshire Street Railway Company, there was a wide fluctuation in the results of the experiment. Initially the incremental revenue exceeded the incremental (contract) cost, with a ratio of 175 per cent in March, 158 in April and 152 in May. At this point the operational difficulties of the Berkshire Street Railway Company, the public confusion as to the reliability of the service and perhaps the normal summer seasonal decline, contributed to the sharp reduction in revenue. For several of the months there was actually a decline in revenue from the base period of the previous year, despite the increases in service.

3. Post Experimental Results.

Yellow Coach retained two of the additional five daily round-trips after the experiment was concluded, retaining those trips which established a pattern that would be financially self-supporting in the judgment of the operator, in the light of the experimental results.

B. Pittsfield: Park Square-Wilson Park (Waconah) Housing Project (Berkshire Street Railway Company-Yellow Coach Lines, Inc.)

1. Description.

a. Physical Setting.

This three mile route terminated at the Wilson Housing Project for the elderly (78 units) running through a comparatively high density triple decker area, completely within the limits of the city of Pittsfield. The fare was 25¢ and the scheduled running time was 15 minutes. The pre-experimental service consisted of 10 round-trips daily, with no service on Sunday.

b. Purpose.

The purpose of this experiment was to measure the effects of increasing the frequency of local bus service in the more densely populated sections of the core city of a small SMSA.

c. Experimental Changes.

Five additional round-trips were added daily except Sunday, with no change in fare.

The Berkshire Street Railway Company began the operation of this experimental service on March 11, 1963, but the Commission terminated this contract with Berkshire effective May 31, 1963 for non-performance. Yellow Coach Lines then operated the service under the contract with the Commission from June 7, 1963, to January 15, 1964, when the experiment was completed.

2. Results.

Initial incremental revenue fare exceeded the incremental (contract) cost for most of the experiment, but in an erratic

TABLE 50

PITTSFIELD LOCAL SERVICE EXPERIMENTS
INCREASED SERVICE PITTSFIELD
PARK SQUARE-GREENRIDGE HOUSING PROJECT.
(Berkshire Street Railway Company – Yellow Coach Lines, Inc.)

Period	Under Experiment	Year Ago	Increase	Gross Contract Cost*	Rev. Increase/ Cost	Average Weekday Inbound Passengers
March 11-31	$ 913	$ 409	$ 503	$ 288	174.9%	100
April	1,221	623	598	377	152.4	100
May	1,020	656	364	240	151.8	120
June 7-30	560	453	107	292	36.7	60
July	385	569	(124)	380	(48.4)	30
August	759	935	(176)	395	(44.5)	60
September	840	903	(63)	351	(18.0)	70
October	850	926	(76)	380	(20.1)	70
November	763	988	(225)	351	(64.1)	60
December	908	474	434	366	112.8	70
Jan. 1-14, '64	420	649	(229)	161	(142.5)	80
3/11/63–1/14/64	$8,639	$7,586	$1,054	$3,582	29.4	70

* Basis: 3/11–5/31/63: 49.207 cents per mile (operated by Berkshire); 6/7/63–1/14/64: 45 cents per mile (operated by Yellow Coach Lines, Inc.)

TABLE 51

INCREASED SERVICE PITTSFIELD:
PARK SQUARE-WILSON PARK HOUSING
(Berkshire Street Railway Company – Yellow Coach Lines, Inc.)

Period	Under Experiment	Year Ago	Increase	Gross Contract Cost*	Rev. Increase/ Cost	Averoge Weekday Inbound Possengers
March 11-31, 1963	$ 2,532	$ 1,696	$ 836	$ 266	314.5	280
April	3,275	2,490	785	257	305.4	270
Moy	2,816	2,470	346	124	279.0	330
June 7-30	1,038	2,044	(1,606)	321	313.0	100
July	2,501	2,114	387	340	113.8	190
August	2,478	2,399	99	351	28.1	180
September	2,157	1,958	199	313	63.6	180
October	2,164	2,497	(333)	343	(97.2)	170
November	2,612	2,976	(364)	310	(117.2)	220
December	3,326	3,050	276	327	84.5	270
Jon. 1-14, 1964	1,456	1,816	(360)	143	(251.7)	260
3/11/63–1/14/64	$26,354	$25,491	$ 865	$3,096	27.9	220

* Basis: 3/11–5/31/63: 49.207 cents per mile (operoted by Berkshire); 6/7/63–1/14/64: 45 cents per mile (operated by Yellow Cooch Lines, Inc.)

and declining pattern. The erratic pattern, again, may have been due to the difficulties of the Berkshire Street Railway Company, a consequent lack of confidence in the reliability of service on the part of the public, and the normal summer seasonal decline.

3. Post Experimental Results.

The Yellow Coach continued three of the five additional round-trips at the conclusion of the experiment. The operator established an improved pattern of service which he believed would be self-sustaining in the light of the experimental results.

C. Pittsfield: Park Square-Francis Plaza Housing Project (Berkshire Street Railway Company — Yellow Coach Lines, Inc.)

1. Description.

a. Physical Setting.

The Francis Plaza Housing Project for the elderly (64 units) was located at the terminal of the new service, approximately 1.25 miles along city streets from Park Square in downtown Pittsfield. The route traversed a densely populated residential area.

b. Purpose.

The purpose of this experiment was to measure the effects of new service in a densely populated portion of the core city of a small SMSA.

c. Experimental Changes.

The new route was 1.25 miles in length with a scheduled running time of five minutes and at a fare of 25¢. Six round-trips were provided daily, with no service on Sunday. The experiment began on March 11, 1963 by the Berkshire Street Railway Company. The Commission terminated this contract with Berkshire effective May 31, 1963 for nonperformance. Yellow Coach Lines then operated the service under contract with the Commission from June 7, 1963 to December 4, 1963.

2. Results.

There was a highly erratic revenue pattern for this new service for the same reasons as described above: the financial difficulty of the Berkshire Railway Company and a public lack of faith in the reliability of the new service were both disruptive factors during the experimental period.

TABLE 52

NEW SERVICE PITTSFIELD:
PARK SQUARE-FRANCIS HOUSING PLAZA
(Berkshire Street Railway Company –
Yellow Coach Lines, Inc.)

Period	Revenue	Gross Contract Cost*	Revenue/ Cost	Av. Weekday Inbound Poss-engers
March 11-31	$ 46.57	$ 88.57	52.6%	5
April	135.11	114.81	117.7	11
Moy	77.42	69.71	111.1	10
June 7-30	25.00	132.75	18.8	2
July	30.00	175.50	17.1	2
August	35.00	178.88	19.6	3
September	40.50	162.00	25.0	3
October	35.00	175.50	19.9	3
November	38.00	162.00	23.5	3
December 1-4	2.00	20.25	9.9	1
	$464.60	$1,279.97	36.3	4

* Basis: 3/11–5/31/63: 49.207 cents per mile (operated by Berkshire); 6/7–12/4/63: 45 cents per mile (operated by Yellow Coach, Inc.)

D. Newburyport: High Street (Massachusetts Northeastern Transportation Company)

1. Description.

a. Physical Setting.

High Street is one of the main streets in Newburyport, an old city whose population has declined in recent years. The pre-experimental route was 2.2 miles in length with a

scheduled running time of 10 minutes and a fare of 25¢. Prior to the experiment nine round-trips were scheduled daily, with no service on Sunday.

Massachusetts Northeastern equipment was 20 years old, of the transit type, and in poor condition.

b. Purpose.

The purpose of the experiment was to measure the effects of an increase in service and an extension of a local route in a small urban area to a new housing area composed of both single family average income dwellings and apartment units for the elderly (50 units).

c. Experimental Changes.

The former route of 2.2 miles was extended half a mile (totaling 2.7 miles) to provide direct service from the new residential areas to the downtown section of the city. Two additional round-trips were added to the previous nine to provide an hourly pattern of service. There was no change in fare. The experiment began March 11, 1963 and concluded August 31, 1963.

2. Results.

This experiment showed a pattern of increases in revenue, although the comparatively small incremental (contract) monthly cost resulted in apparently wide fluctuations in the percentage relationships between incremental revenue and incremental costs. Revenue increases averaged 47 per cent of the incremental cost.

MTC staff surveys of the passengers utilizing this experimental service showed that most of the new passengers were school children.

TABLE 53

NEWBURYPORT LOCAL ROUTE EXTENSION AND SERVICE INCREASE
(Massachusetts Transportation Co.)

Period	1963	1962	Increase	Gross Contract Cost †	Rev. Incr./ Cost	Av. Weekday Inbound Passengers
March 11-31	$ 271.35	$ 247.08	$474.62	$ 123.06	19.7%	25
April	400.90	285.48	115.42	177.83	64.9	45
Moy	372.53	345.39	27.42	177.83	15.3	35
June	288.57	265.98	22.59	170.75	13.2	26
July	237.85	148.50	125.35	177.83	70.5	24
August	348.40	188.50	159.85	184.50	86.6	29
3/11–8/31/63	$1,955.60	$1,480.98	$474.62	$1,011.80	46.9%	31

† Basis: 46.275 cents per mile.

3. Post Experimental Results.

The management of the company retained the route extension upon the completion of the experiment, but cut the service over the entire route to two round trips per day.

E. Fall River (Eastern Massachusetts Street Railway Co.)

1. Description.

a. Physical Setting.

Fall River (99,942) is the core city of a small SMSA with a total population of 123,951. The Fall River area ha been classified as a distressed area by the Area Redevelop ment Administration. The population has a below averag family income. Much of its textile industry has left the area

During the course of the experiment this city was under going extensive highway construction which caused seriou disruption of normal traffic patterns, with frequent change of routes (both bus and automobile), complicated by con siderable traffic congestion extending well beyond the norma peak hours because of the construction.

The Eastern Massachusetts Street Railway Company operated seven local routes completely within the city limit of Fall River with eight year old transit type equipment in good condition at a local fare of 25¢.

b. Purpose.

The purpose of this experiment was to test the net cos and ability of increased service to retain normal levels o passenger volume during a period of abnormal disruption o traffic patterns due to interstate highway construction in a downtown urban area.

c. Experimental Changes.

Service frequency was increased by approximately 20 per cent, with an increase of monthly scheduled miles from 70,000 to 84,000. There was no change in fare. A common loading point was established as part of the experimental pattern. The experiment began August 11, 1963, and was concluded on February 9, 1964.

A normal revenue base was established by using the average revenue received in the months of March-June 1962. This was required because satisfactory comparable time periods for revenue comparison purposes could not be established because of fare changes in 1962 and 1963 and serious disruptions of service due to snow storms in the winter of 1963. When the Fall River experiment started

TABLE 54

FALL RIVER LOCAL SERVICE INCREASE EXPERIMENT
(Eastern Massachusetts Street Railway Co.)

Period	Rev. Under Experiment	Base Revenue*	Experiment Rev./ Bose Rev.	Av. Weekday Inbound Passengers***
Aug. 11-31, '63	$ 19,677	$ 23,931**	82.2%	2,400
September	31,558	35,327	89.3	2,850
October	34,742	35,327	98.3	3,150
November	29,829	35,327	84.4	3,000
December	36,277	35,327	102.7	3,300
Jan. 1-Feb. 9, '64	36,300	35,327	102.7	3,300
	$188,383	$200,565	93.9%	3,000

*Monthly average of revenue on Fall River local service, March-June 1962.
**Bose, as above, pro-roted for portion of month during which experimental service wos operoted.
***Base, Actuol count of week of Jonuory 20-24, 1964.

LOWELL :

GENERAL LAND USES

BUS ROUTES

RESIDENTIAL

- Single family
- 2-3-4 Family
- Multiple dwellings, boarding and rooming houses, taurists and trailer courts

BUSINESS

- Local, general, and intensive business offices and banks

INDUSTRIAL

- Light and heavy industry

PUBLIC

- Parks, public schools and public buildings

QUASI PUBLIC

- Churches, cemeteries, public utilities, parachial schools, private hospitals and golf courses

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LOWELL, MASS.
CITY PLANNING DEPT.
0 500 1000 2000 3000
SCALE IN FEET

fares were at the same level as during the base months in 1962.

2. Results.

The experiment halted and reversed the previous decline in passenger volume, with a pattern of increasing public use. However, almost no incremental revenue developed to off-set the incremental cost arising from the 20 per cent increase in miles operated.

3. Post Experimental Results.

Upon completion of the experiment the company dropped most of the additional service but temporarily retained the common loading point in the downtown area.

F. Lowell (Eastern Massachusetts Street Railway Co.)

1. Description.

a. Physical Setting.

Lowell (92,107) is the core city of the Lowell SMSA with a total population of 118,547. The Lowell SMSA has been included in the Greater Boston region as defined jointly by the HHFA and the MTC, and subsequently by the Massachusetts Department of Public Works and the Federal Bureau of Public Roads for comprehensive mass transportation and highway planning purposes.

The Lowell area has been officially classified as a distressed area by the Area Redevelopment Administration. A good deal of the textile industry formerly located in the city of Lowell has relocated to other portions of the country, resulting in high unemployment and below average family income and an above normal proportion of elderly citizens.

The Eastern Massachusetts Street Railway Company operated 17 local routes almost completely within the city of Lowell. No Sunday service was operated. The established fare was 25¢. The equipment used in Lowell local service was transit type, 10-15 years old but mostly in good condition. There had been a continuing pattern of declining passenger volumes and revenues from this local service, accompanied by increasing automobile congestion in the downtown area.

b. Purpose.

The purpose of this experiment was to test whether a drastic off-peak fare reduction for local service to the center of the core city of a small SMSA could result in improved patronage and increased utilization of available vehicles and crews.

c. Experimental Changes.

The regularly established all day fare of 25¢ was reduced to 10¢ for all trips originating in the off-peak period only, between the hours of 10 a.m. and 3 p.m., for all bus trips within 1.5 miles of Kearney Square, the focal point of downtown Lowell, Monday through Friday. This experiment began on December 10, 1962 and was concluded on March 9, 1963.

2. Results.

The reduced fare resulted in off-peak passenger volume increases to an overall 79 per cent. The incremental fare box revenue resulting from the incremental volume was however insufficient to offset the reduction of the fare from 25¢ to 10¢.

Many of the weekly increases in passenger volume were in the 73 to 84 per cent range, with exceptional weeks ranging from a low of 62 per cent to a high of 114 per cent for Christmas week.

TABLE 55

CITY OF LOWELL
Off-Peak Fare Reduction Experiment.
(Eastern Massachusetts Street Railway Company)

Period	Total Revenue – All Fare Classes: Base Period	Total Revenue – All Fare Classes: During Experiment	Experiment Rev./Base Revenue	Passenger Increase
Dec. 10-14, 1962	$ 1,777.75	$ 1,169.45	65.8%	4,970
Dec. 17-21	1,777.75	1,218.50	68.5	5,453
Dec. 24-28*	1,442.20*	1,078.20	75.8	5,333
Dec. 31, 1962 Jan. 4, 1963*	1,422.20*	885.80	62.3	3,591
Jan. 7-11	1,777.75	1,102.45	62.0	4,342
Jan. 14-18	1,777.75	1,022.05	57.5	3,626
Jan. 22-25	1,777.75	1,013.00	57.0	3,431
Jan. 28-Feb. 1	1,777.75	1,106.35	62.2	4,316
Feb. 4-8	1,777.75	1,196.58	67.3	4,975
Feb. 11-15	1,777.75	1,097.65	61.7	4,260
Feb. 18-22	1,777.75	1,110.55	62.5	4,445
Feb. 25-Mar. 1	1,777.75	1,164.15	65.5	4,934
Mar. 4-8	1,777.75	1,161.25	65.3	4,824
	$22,399.65	$14,325.98	64.0%	58,500

* 4 days only, owing to holiday; base period revenue and adult cash fare passenger counts pro-rated accordingly.

G. Fitchburg: Fitchgate Shopping Center (Fitchburg and Leominster Street Railway Company)

1. Description.

a. Physical Setting.

Fitchburg (43,021) is the core city of the Fitchburg-Leominster SMSA with a total population of 72,347. The Fitchgate Shopping Center is approximately two miles from downtown Fitchburg, with the intervening area consisting primarily of multiple family units in the immediate vicinity of downtown Fitchburg and low population density with single family units of post-war suburban development type predominating near the Fitchgate Shopping Center. The family incomes tended to rise from lower to middle and above average going outward from downtown Fitchburg to the end of the new route.

b. Purpose.

The purpose of the experiment was to test the effects of new urban local service (Monday through Saturday) from the downtown core to a suburban shopping center through intervening residential sections.

c. Experimental Changes.

Half hour frequency for the 1.8 mile route was provided

at a basic fare of 20¢ for the first six months of the experimental period March 11, 1963 to November 16, 1963 with a fare increase to 25¢ for the experimental period from November 17, 1963 to February 29, 1964. The operator increased his fares in November for his entire system. Since six months' results had been obtained under the 20¢ fare, the increase to 25¢ was allowed to test the effect on the passenger pattern. Transit type equipment of 8-10 years of age and in good condition was utilized.

2. Results.

There was a steady pattern of increase in passenger use of this new service, except for minor decreases when the fare increase went into effect. The average daily outbound weekday passenger volume varied between 64 in April to 81 in February, with an average of 74 for the experimental period. The ratio of revenue to incremental (contract) cost similarly showed a pattern of growth from 42 per cent in April to 63 per cent in February, for an overall average of 54 per cent.

TABLE 56

FITCHGATE PLAZA SHOPPERS' SERVICE – NEW SERVICE
(Fitchburg & Leominster Street Railway Company)

Period	Revenue	Gross Contract Cost †	Revenue/ Cost	Av. Weekday Inbound Passengers
March 11-31, '63	$ 234.28	$ 797.24	29.4%	40
April	480.01	1,149.05	41.8	64
May	521.89	1,156.29	45.1	65
June	536.33	1,117.20	48.0	70
July	491.51	1,161.59	42.3	55
August	603.44	1,217.57	49.6	63
September	599.32	1,080.52	55.5	73
October	760.20	1,171.25	64.9	97
November	703.31	1,028.88	68.4	100
December	846.85	1,116.71	75.8	89
Jonuory, 1964	715.42	1,162.08	61.6	79
Februory	700.62	1,116.71	62.7	81
	$7,193.18	$13,275.09	54.2%	74

† Bosis: 48.259 cents per mile.
†† Fore increose put into effect November 17, 1963

H. Cleghorn, Fitchburg-Leominster (Fitchburg and Leominster Street Railway Company)

1. Description

a. Physical Setting

Leominster (27,929) is the second urban center of the Fitchburg-Leominster SMSA. The two cities have a common boundary, with the urbanized area of one contiguous with the urbanized area of the other. The pre-experimental main line bus route between Fitchburg and Leominster served the centers of the two cities and the high density areas between.

Within the Cleghorn section in Fitchburg are some new low density residential sections where family incomes are above average, and some older, mixed residential sections where incomes are below average.

The pre-experimental service was 7.9 miles in length with a scheduled running time of 30 minutes. Frequency was 10-20 minutes in the peak period, 20 minutes in the afternoon and one hour in the evening. Saturday frequency varied from 20 minutes to 1 hour, with 1 hour frequency on Sunday. The fare was 20¢. All local service provided by this company utilized 8-10 year old transit type equipment in good condition.

b. Purpose.

The purpose of this experiment was to test the effect of a route extension of local urban service into a new residential district in a small urban area, with increased frequency provided for the total system in the afternoon only.

c. Experimental Changes.

Two simultaneous experimental service changes were made.

i. The base main line route was extended half a mile, providing a total 8.4 mile route with an hourly running time. The route was extended to the new residential section for the entire day.

ii. Frequency for the prior existing route was doubled in the afternoon between 1:40 p.m. and 6 p.m. Monday through Saturday, increasing the number of trips from 12 to 24, to provide a 10 minute frequency pattern throughout the day.

The fare was 20¢ for the first six months of the experiment (March 11, 1963 to November 16, 1963) with a fare increase to 25¢ for the remainder of the experimental period (November 17, 1963 to February 29, 1964) in conjunction with a system fare increase. Since six months results had already been obtained, the fare increase for the experimental route was also allowed.

TABLE 57

MAIN LINE SERVICE INCREASE AND EXTENSION
(Fitchburg and Leominster Street Railway Co.)

Period	Revenue 1963	Revenue 1962	Rev. Increase	Gross Contract Cost	Rev. enue/ Cost	Av. Weekday Inbound Passengers
Morch 11-31, '63	$ 8,847	$ 8,536	$ 311	$ 2,561	12.2%	1688
April	12,522	11,435	1,088	3,700	29.4	1634
May	12,188	11,159	1,029	3,700	27.8	1660
June	10,913	10,942	(30)	3,558	-0.8	1516
July	9,479	8,755	724	3,700	19.6	1176
August	11,368	10,438	930	3,842	24.2	1308
September	10,293	9,230	1,064	3,377	31.5	1417
October	12,655	11,240	1,415	3,700	38.3	1688
November ††	11,639	10,995	644	3,416	18.9	1628
December	14,561	11,974	2,587	3,558	72.7	1723
Januory, 1964	14,990	12,238	2,752	3,700	74.4	1672
Februory	14,035	11,082	2,953	3,558	83.0	1616
	$143,491	$128,021	$15,469	$42,370	36.5%	1561

† Basis: 48.259 cents per mile.
†† Revenue increose put in effect November 17, 1963.

2. Results

For record keeping purposes, new revenue from the route extension was lumped together with revenue resulting from the increased service.

The experimental service resulted in a steady increase in passengers and revenue until the increase in fare was put into effect, when there was a brief decline for only one month. The earlier patronage increase continued through the holiday shopping season with a substantial decline for the months of January and February 1964.

VI Direct Service to Industrial Plants

A. Western Electric-North Andover (Massachusetts Northeastern Transportation Company)

1. Description.

a. Physical Setting.

The area served by this route is a low density river valley in northeastern Massachusetts. The service traverses three communities, Amesbury (10,077), Merrimac (3,261) and Haverhill (46,346) en route to an industrial plant located in North Andover. Population in these communities has been constant for the last 25 years. The Merrimac River valley has undergone substantial changes in its economic base since World War II; electronics and electrical machinery have to some degree replaced the abandoned textile industry. Consequently, several large elctronic plants have been constructed in the suburban areas.

Prior service was not continuous between these small cities and towns to the electronics plant, which had a total employment of 10,000 semi-skilled, skilled and professional workers. Going from Amesbury to the plant in North Andover by public transportation required extensive waiting time between buses. The only pre-experimental service directly to the plant was one trip Monday through Saturday from Haverhill.

b. Purpose.

The purpose of this experiment was to measure the effect of a direct service to a large industrial plant through several small communities and a city.

c. Experimental Changes.

The experimental service consisted of joining into one continuous route, segments of two existing routes to provide direct service to and from the door of the Western Electric plant. The 16 mile route, with a scheduled running time of 30 minutes, was made with transit and suburban type equipment 20-25 years old, in poor condition.

There were two trips from Amesbury to the plant and three trips from Haverhill to the plant, Monday through Friday. The fare was 50¢ from Amesbury and 25¢ from Haverhill. Service began on March 11, 1963 and the experiment concluded on August 31, 1963.

2. Results.

During the experiment ridership increased very slightly

TABLE 58

WESTERN ELECTRIC PLANT SERVICE
(Massachusetts Northeastern Transportation Company)

Period	Revenue 1963	Revenue 1962	Revenue Increase	Gross Contract Cost †	Rev. Incr./ Cost	Av. Weekday Inbound Passengers
March 11-31	$ 348.89	$ 340.65	$ 8.24	$ 719.11	1.1%	14
April	501.55	503.40	(1.85)	1,054.70	(0.2)	20
May	430.60	490.45	(59.85)	1,054.70	(5.7)	16
June	386.20	464.85	(78.65)	958.82	(8.2)	15
July ††	246.00	192.65	53.35	576.29	9.3	13
August	471.00	417.35	54.05	1,054.70	5.1	17
	$2,384.14	$2,409.35	$(24.71)	$5,418.32	(-0.5)	16

† Basis: 46.275 cents per mile.
†† Plant closed (holiday and vacation period).

the first month, declined during the early summer and increased slightly in the late summer. The revenue increase was so small in comparison to the incremental (contract) cost that the minor fluctuations in per cent were themselves meaningless.

B. Fitchburg-Local Industrial Plants (Fitchburg and Leominster Street Railway Company)

1. Description.

a. Physical Setting.

There were three industrial plants located within the city limits of Fitchburg, approximately 1.8 to 2.4 miles from the residential areas of the city that, previous to this experiment, did not have direct "door to door" service. These plants employed 800 and 1,060, for a total of 1,860.

b. Purpose.

The purpose of this experiment was to test the effect of new direct service to three industrial plants within the city limits of the core of a small SMSA.

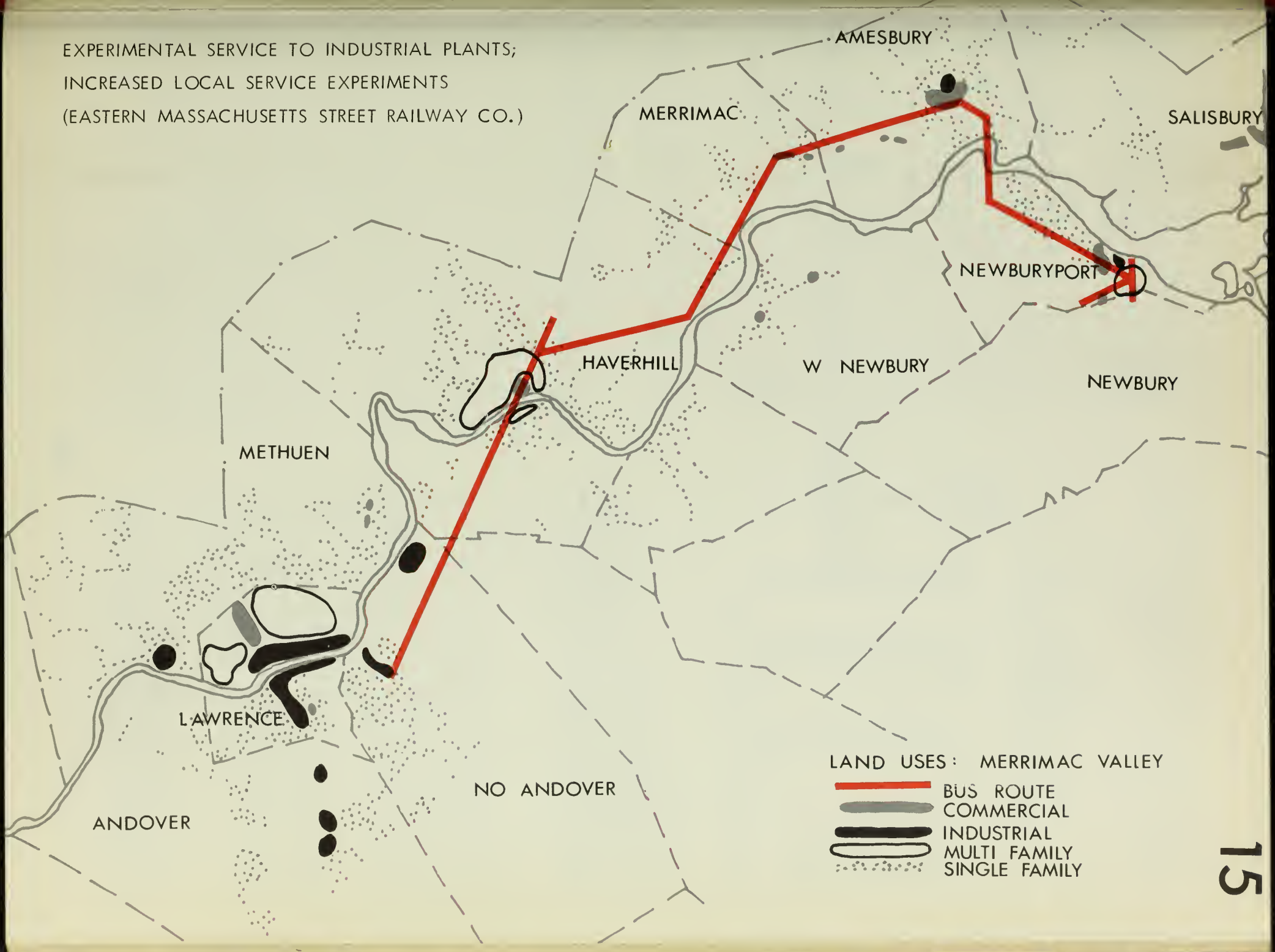
c. Experimental Changes.

One trip was provided in the morning and one in the evening, Monday through Friday. The trips averaged about 2.0 miles in length. The fare was 20¢ for the first six months of the experiment, March 11, 1963 to November 16, 1963. The company was allowed to increase the fare to 25¢ for the remainder of the experimental period, November 17, 1963 to February 29, 1964, in conjunction with a system fare increase.

2. Results.

The minor fluctuations in passenger volumes (from 23 for the lowest average weekday to a maximum of 38) had a comparatively heavy impact on the ratio of revenue to contract cost, primarily because of the low contract cost. The ratio varied from 39 per cent in March, 1963, with a steady pattern of growth to a high of 83 per cent in December 1963 and 77 per cent in February, 1964, for an overall average of the entire experiment of 62 per cent.

EXPERIMENTAL SERVICE TO INDUSTRIAL PLANTS;
INCREASED LOCAL SERVICE EXPERIMENTS
(EASTERN MASSACHUSETTS STREET RAILWAY CO.)



At the conclusion of these industrial plant experiments, the company kept the service because it could utilize drivers and buses which would have been otherwise un-utilized; consequently, a low threshold cost is incurred.

TABLE 59

SERVICE TO THREE INDUSTRIAL PLANTS – NEW SERVICE
(Fitchburg & Leominster Street Railway Company)

Period	Revenue	Gross Contract Cost †	Revenue/ Cost	Av. Weekday Inbound Pass-engers
March 11-31, '63	$ 55.77	$ 141.88	39.3%	23
April	122.26	209.15	58.5	31
May	101.07	209.15	48.3	26
June	98.42	190.14	51.8	28
July	99.99	209.15	47.8	25
August	113.55	209.15	54.3	29
September	106.96	190.14	56.3	30
October	153.73	218.66	70.3	38
November ††	139.89	180.63	77.4	38
December	166.02	199.65	83.2	38
January, 1964	164.97	209.15	78.9	35
February	147.07	190.38	77.3	34
	$1,469.70	$2,357.23	62.3%	31

† Basis: 48.259 cents per mile.
†† Fare increase put in effect November 17, 1963.

VII. Findings

1. Suburban Service to the Core

Carefully selected service improvements from suburban communities to the downtown core of a major urban regional center can be self-sustaining.

2. Suburban Service to Small Cities

In several new and increased service experiments between suburban communities and the city centers of smaller urban areas, the cost of the improved service greatly exceeded the incremental fare-box revenue.

3. Feeder Service

Bus feeder service from densely populated urban areas to rapid transit stations is economically feasible. Feeder services from low density suburban communities to railroad stations where direct service to the major regional city core was provided, were not economically feasible.

4. Local Service in Small Urban Areas

Carefully selected local service improvements in smaller urban areas can be self-sustaining.

5. Direct Service to Industrial Plants

Special service during peak hours to industrial plants, which have free and available parking for employees, will not recover operating costs from fare-box revenues unless the equipment and operator is otherwise available and not utilized. In rare instances, incremental direct operating costs may be recovered.

6. Off-Peak Fare Reduction

Off-peak fare reductions by themselves did not generate sufficient new ridership to off-set reductions in revenue.

7. Costs

In private bus company operations, the greater portion of costs vary almost directly in proportion to miles operated, with only a minor portion of total costs being fixed costs.

Chapter Six

MTA Experiments

I. Negotiations

A. General Background

Throughout the period when the Recess and MTC Joint Report was being evolved, the Chairman of the MTA, an ex-officio member of the MTC, was Chairman of the Commission. Further, two other members of the MTC had close ties with the MTA. One public member, who had served on the MTC from the beginning in 1959, was then the president of the largest union on the MTA property. Another member of the Commission was serving in his ex-officio capacity on the MTC while on leave from the MTA, where he had been an employee for over 20 years. Therefore the MTA was fully aware of the evolution of the objectives and contents of what was to become the MTC demonstration program.

As with the bus companies and railroads, the MTC staff and consultants reviewed MTA operations with the cooperation of the MTA staff. Direct experiments with the whole of the MTA's vast rail rapid transit system were determined to be inappropriate for this program because a meaningful experiment of this magnitude would involve an expenditure of far more money than would be available. An experiment with a portion of the MTA rapid transit operations was a practical impossibility because of the incapability of isolating any one portion from the whole and of maintaining adequate controls.

Similarly it was determined that experiments with fare reductions would be impractical since the MTA had made substantial changes in its entire fare structure in the fall of 1961. Insufficient time had elapsed to provide an adequate base for control and measurement purposes for any experimental change in fare structure in the near future.

B. Contract Price

1. Mileage costs

For several years the MTA had maintained an extensive and intensive system of records, including a detailed allocation of costs for each of the various types of service as well as for individual routes within a type. Therefore mileage payments provided for in MTC contracts with the MTA varied from experiment to experiment, but in each instance were based upon the figures long developed and maintained by the public transit authority.

When new service was provided it was possible to utilize the records of the MTA to arrive systematically at a reasonably accurate approximation of the incremental costs on a mileage basis. An analysis of the MTA's costs for individual experiments is included in the Supplement Three to this report prepared by SARC.

2. Training

In order to provide the additional service required by the experiment, the MTA hired 81 additional operators. Provision was made in the MTC-MTA contract for the reimbursement of actual labor supervision and movement costs

in the training of this additional help, with the stipulation that if the individuals were retained on the expiration of the experimental service. the MTC obligations to the MTA would be correspondingly reduced by the amount spent in the training of the individuals retained. The basis of this provision was the possibility that training of these individuals would be a "one time" expense for the Authority arising solely from the MTA's participation in the MTC experimental program. However, if any of the additional individuals retained from the program remained with the MTA on the completion of the experiments, then it was agreed that the initial training of these individuals could properly be re-classified as a normal MTA operational expense instead of a special incremental expense due solely to the MTA participation in the MTC program.

Upon the completion of the experiment 76 of the 81 individuals remained in the service of the MTA and the obligations of the Commission therefore were correspondingly reduced in accord with the contract.

3. Advertising

There were several individual contracts with the MTA for various experiments. The initial contracts, for bus service beginning in June 1963, made no provision for advertising. For several years the MTA had no separate provision in its own budget for advertising purposes. Since it operates so many different types of service and different routes within a fairly compact but nevertheless highly diversified urban area, the MTA had no established program of promotion for any one of its routes or types of service. Instead, in recent years, the MTA had generally restricted its advertising to the institutional variety, encouraging patronage of the system as a whole.

On the other hand, the MTA did and does have a small but highly effective public relations department. Frequently the MTA received considerable publicity in the press concerning its service. For example, the public relations section was successful in obtaining extensive coverage in the press, radio and TV whenever the MTA replaced obsolete rolling stock with new equipment.

In subsequent contracts with the MTA, however, what had then become the customary advertising provision was inserted, providing for a separate advertising budget for the individual experiments of one, later two, per cent of the gross cost of the experiment.

During the course of these experiments, the MTC staff encouraged and assisted the MTA in reviving and improving an old procedure of the issuance of timetables for the convenience of the riding public. Originally these timetables were issued only for the experimental routes. However, the reception of these timetables by the public was so positive and effective that after the experiment had been completed the MTA trustees reestablished as a standard operating procedure the issuance of timetables for all of its routes. The MTC staff assisted the MTA in the design of what has now become the standard form of MTA timetables for the public

C. MTC Monitoring

The highly developed data and record system maintained by the office of the Comptroller-Treasurer of the MTA greatly facilitated and simplified MTC staff monitoring of MTA records. As with the bus companies, the office of the Auditor of the Commonwealth reviewed the auditing procedures by the MTC of the MTA and the records of the MTA pertaining to the experiment and corroborated the findings of the MTC staff that the MTA records were well in order.

The MTC staff conducted several surveys of the patrons of the MTA experiments, both during and after the experimental period. These are discussed in some detail in Chapter Seven, entitled "Market Surveys."

D. Applicability of MTA Experiments

In determining the specific applicability of the results and findings of MTA experiments, planners and transportation experts should compare the environment of the experiments with their own circumstances.

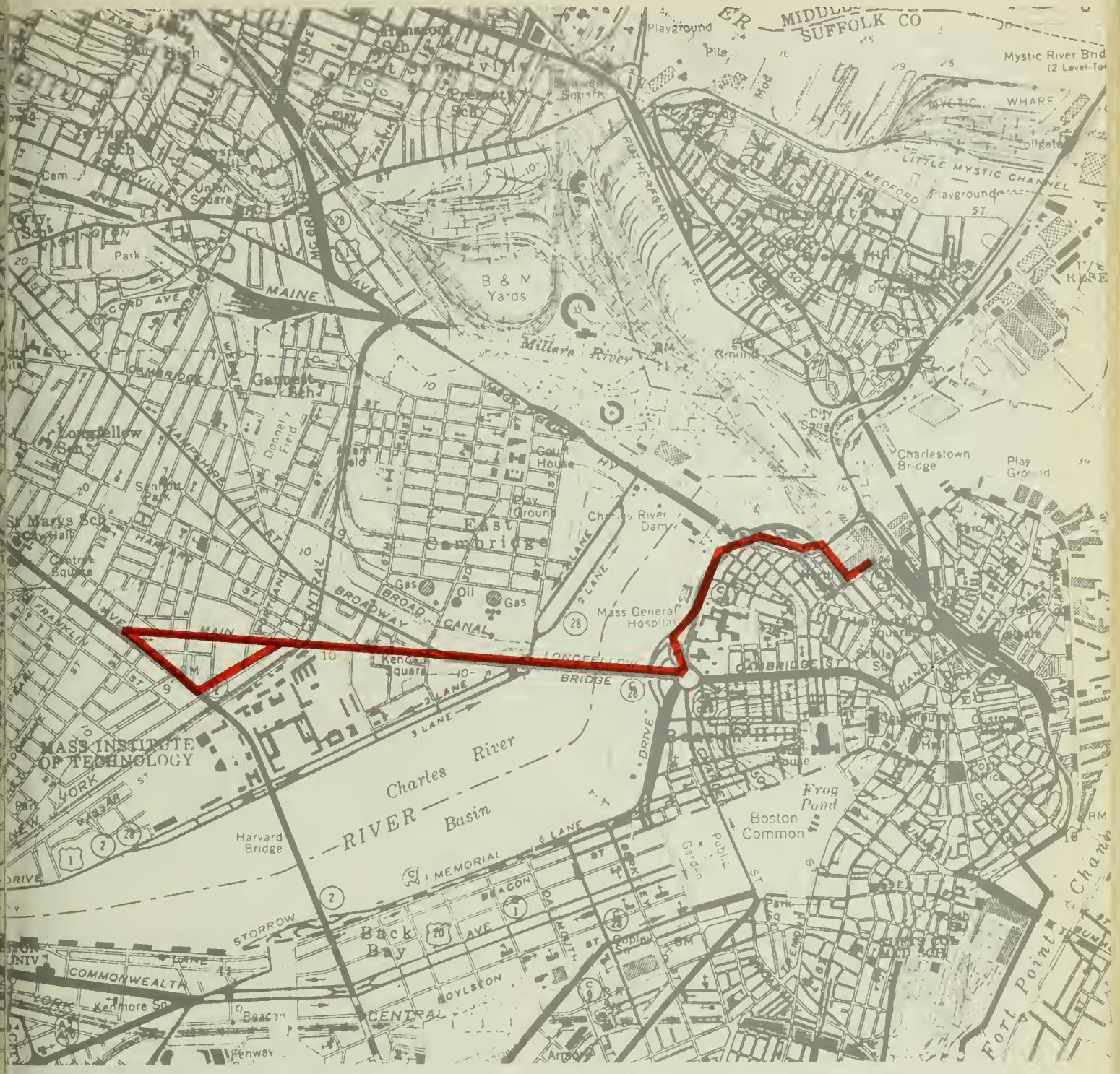
1. Physical Setting

The MTA is a publicly owned and operated transit system whose operations are confined to fourteen cities and towns in the core of the greater Boston region. The MTA serves a 123 square mile area with a 1960 population of slightly under 1.5 million. (See Supplement One).

2. Mileage Costs and Fares

During the preliminary MTC-MTA negotiations it was established that MTA bus costs varied greatly from route to route. Both movement costs and platform costs were included in establishing incremental (contract) mileage costs for the individual MTA experiments.

Movement costs consist of those factors needed to move a standard vehicle one mile (fuel, tires, insurance, etc.). A basic movement cost of 35 cents per mile was established for all scheduled MTA bus mileage.



NORTH STATION – M I T ROUTE

Platform costs are the direct wage costs expressed in terms of miles operated for the particular route. Commission payments to the MTA included payments for all actual operators' wages paid from reporting time at the barn (garage) until the end of the day's tour of duty. Platform costs for the MTA experiments varied from 31 cents per mile to 93 cents per mile.

Consequently, total costs for MTA compensation for miles operated (movement plus platform costs) varied from 66 cents to $1.28 per mile.

II. Downtown Distribution

A. North Station-M.I.T.

1. Description

a. Physical Setting

Prior to this experiment there was no direct bus or rapid transit service from the North Station area of Boston, which contained the terminal of the B&M Railroad as well as stations on two of the MTA rapid transit lines, to university-research and development industrial area around Massachusetts Institute of Technology in Cambridge. Representatives of the MIT community had requested the MTC to test the feasibility of direct bus service between these two areas in the belief that many of the students, professors and professional employees of the research and development industrial sector were commuters on the B&M or residents of communities adjacent to the rapid transit lines with stations at the North Station area. While it was possible to utilize public transportation from the North Station area to reach this area of Cambridge, the ride was circuitous, involved two changes and a total fare of 30¢.

The apparent general traffic congestion in this Cambridge area tended to indicate that an improvement in public transportation service might meet with public support.

As with all the MTA bus experiments, the equipment used by the MTA averaged about 3 years of age, was of the transit type and was in good or excellent condition. The standard MTA bus fare was 10¢, without transfer privileges.

b. Purpose

The purpose of this experiment was to test the response to direct bus service between an intown public transportation terminal composed of rail and main line rapid transit stations and a university-research oriented complex located just outside of the downtown core.

TABLE 60

MTA ROUTE E–2: NEW SERVICE BETWEEN NORTH STATION AND MIT.

Period	Revenue	Contract Cost†	Revenue/ Cost	Total Passengers Carried
June 24–30, 1963	$ 69	$ 1,298	5.3%	690
July	694	5,669	12.2	6,940
August	877	5,671	15.5	8,770
September	882	5,181	17.0	8,820
October	1,089	5,907	18.4	10,890
November	919	4,717	19.5	9,190
December 1–27	880	4,834	18.2	8,800
	$5,410	$33,277	16.3%	54,100

† Basis: 83.98 cents per mile.

c. Experimental Changes

Service was provided between 7 a.m. and 7 p.m., Monday to Friday only, with 10 minute headways in the peak hours and 15 minutes during midday. The length of the route was 2.4 miles and the scheduled running time was 12 minutes. The experiment began January 22, 1963 and was concluded December 27, 1963.

2. Results

The average weekday outbound passengers increased from 60 in January to 158 in July and thereafter made steady moderate growth to a peak of 254 in November, dropping to 231 in December, for an overall experimental average of 210. The ratio of revenue to contract cost similarly increased from five per cent the first month to a high of 19 per cent in November, dropping to 18 per cent in December, for a total experiment average of 16 per cent.

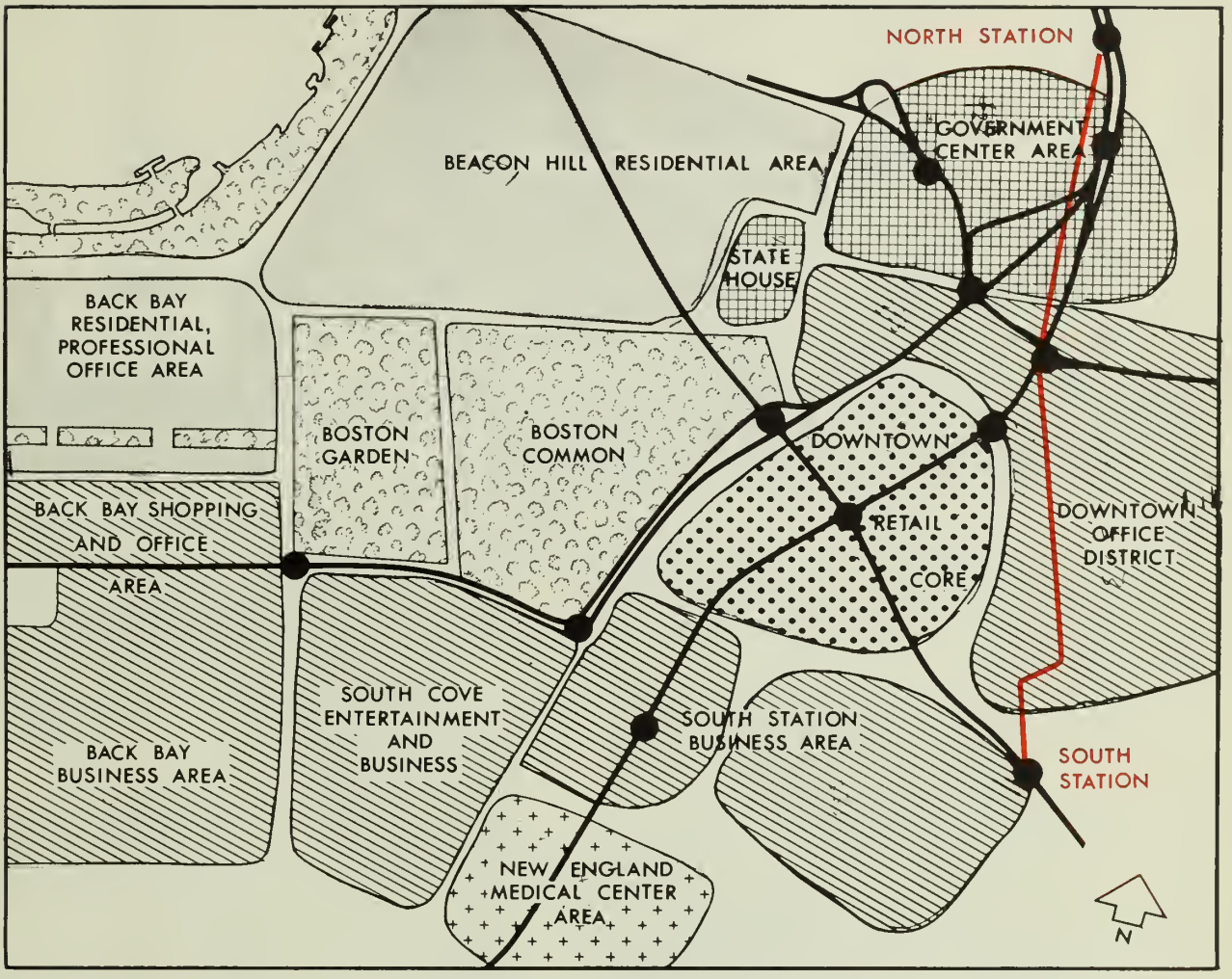
B. North Station-South Station

1. Description

a. Physical Setting

This one mile bus route connecting North Station and South Station passes through a continuous major "white collar" employment district of downtown Boston. Among the traffic generators in this district are several insurance companies, the New England Telephone and Telegraph Company home office, and the Boston financial and legal district. North and South Stations are the major railroad passenger terminals and both contain transfer facilities to different rapid transit lines. Apart from this bus route there is no direct public transportation link between these two railroad terminals.

Prior to the experiment, MTA service on this route was operated at five minute frequency during the peak hours, but at only 25 minute frequency during off-peak mid-day hours. This latter headway was based on the restriction of the route in the off-peak period to one bus. The normal walking time between the two rail terminals was less than the interval between off-peak bus trips.



NORTH STATION – SOUTH STATION ROUTE

SHOWING DOWNTOWN RAPID TRANSIT SYSTEM AND GENERALIZED LAND USES

SOURCE: REPORT, PROPOSED SUBWAY FACILITIES, THE PRUDENTIAL AND GOVERNMENT PROJECTS, M.T.A., MARCH 1959.

TABLE 61

NORTH STATION-SOUTH STATION SERVICE

Phase I – 6/24 – 12/27/63††

Period	Under Experiment	Year Ago	Rev. Incr.	Gross Contract Cost†	Rev. Incr/Cost	Rider Incr/Day	Total Passengers Carried
June 24–30	$ 1,398	$ 939	$ 459	$ 1,121	41.0%	918	13,980
July	6,706	3,804	2,902	4,980	58.3	1,319	67,060
August	7,229	3,999	3,230	5,051	64.0	1,468	72,290
September	7,083	4,100	2,983	4,408	67.7	1,491	70,830
October	8,002	4,810	3,192	5,069	63.0	1,388	80,020
November	6,796	4,182	2,614	3,973	65.8	1,524	67,960
December	8,027	4,660	3,367	4,410	76.4	1,604	80,270
6/24–12/31 1963††	$45,241	$26,494	$18,748	$29,012	64.6%	1,441	452,410
**Phase II – 12/30/63 – 3/27/64†† **							
January	$ 8,482	$ 5,788	$ 2,694	$ 3,650	73.8%	1,224	
February	8,216	5,309	2,907	3,315	87.7	1,454	
March 1–27	8,181	5,505	2,676	3,318	80.6	1,338	
1/2–3/27/64†††	$24,879	$16,602	$ 8,277	$10,284	80.5%	1,335	

† Basis: 122.50 cents per mile, 6/24–12/27/63; 125.22 cents per mile, 12/30–12/31/63; 128.14 cents per mile 1/2–3/27/64.

†† The entire month of December, 1963 has been allocated to Phase I, despite the fact that Phase II service began on December 30 and, of course, was operated on December 31 as well. Owing to the changing day of the week on which the holidays fell in 1962 and 1963, a meaningful 1962 revenue base for comparison with these two days simply could not be developed.

††† Figures exclude December 30 and 31, 1963, as explained in note above.

b. Purpose

The purpose of this experiment was to measure the effect of substantial increases in off-peak service completely within the downtown area of the core city of a major urban region.

c. Experimental Changes

The experimental service was operated June 22, 1963 through March 27, 1964. Two different levels of increased service were tested. In the first phase, from June 22 through December 28, 1963, service was operated from 7 a.m. to 6 p.m. on a continuous five minute headway. From December 29, 1963 to the completion of the experiment on March 27, the frequency was increased to four minutes during the peak and reduced in the off-peak to eight minutes. The purpose of the change was an attempt to find the most efficient utilization of equipment in view of the established pattern of public usage.

2. Results

There was a consistent increase in ridership counts of the experiment service from June through December, when an adjustment was made in the experimental pattern of service. In the initial phase total ridership counts on an average day increased by approximately 1,300 in July and 1,600 in December. After the service pattern was adjusted the increase in riders averaged 1300 per day.

The incremental revenue arising from the experimental service similarly increased from 41 per cent of the incremental (contract) cost to a high of 88 per cent for February, averaging 65 per cent for the first phase and 80 per cent for the second phase of the experiment.

3. Post Experimental Results

Upon completion of the experiment the MTA continued the second phase pattern of service in its entirety, at least pending as yet unknown patterns in the use of commuter railroad facilities.

III. Increased Off-Peak Suburban Feeder Service to Rapid Transit Terminal

A. Elm Street, Medford to Sullivan Square

1. Description

a. Physical Setting

The established route whose off-peak frequency was increased as a part of this experiment, provided a feeder service through a comparatively low density suburban community to the rapid transit terminal. Prior to the experiment service on this route had been on a five minute frequency in peak hours and a 10 minute frequency in midday off-peak hours.

b. Purpose

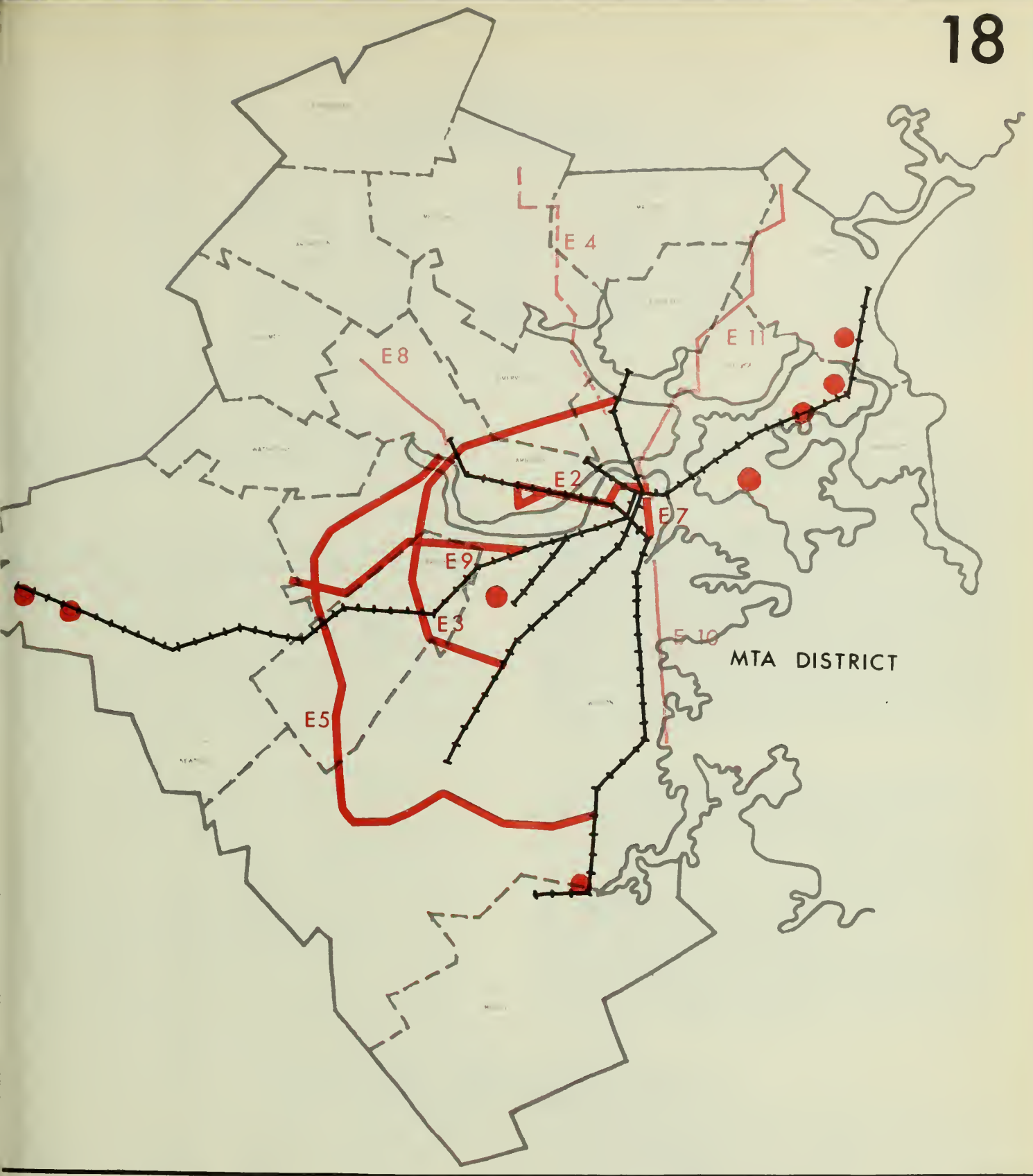
The purpose of this experiment was to measure the effect of increased service in the off-peak period of a suburban feeder service to a rapid transit terminal.

c. Experimental Changes

The weekday off-peak frequency was doubled, from ten to five minutes, providing a five minute pattern throughout the entire day. The experiment began June 22, 1963 and concluded on November 27, 1963.

2. Results

After initial increase in riders and revenue during the first week of the experiment, there was a substantial decline in additional riders and revenue, with the revenue increase never reaching eight per cent of the incremental (contract) cost. The last three months of this experiment showed a steady decline in additional passengers.



MTA EXPERIMENTS

- RAPID TRANSIT
- NEW BUS SERVICE
- INCREASED BUS SERVICE
- PARK·&·RIDE ROUTES
- REDUCED FEE PARKING LOTS

NORTH

1 SQUARE MILE

0 MILES 5

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

TABLE 62

MTA ROUTE E–4: INCREASED SERVICE, ELM STREET, MEDFORD TO SULLIVAN SQUARE

Period	Revenue 1963	Revenue 1962	Rev. Increase	Contract Cost	Rev. Incr/Cost	Rider Incr/Day	Total Possengers Corried*
June 24–30, '63	$ 3,000	$ 2,779	$ 221	$ 1,802	12.3%	442	30
July	11,501	11,156	345	7,916	4.3	156	115
August	11,650	11,067	583	7,906	7.4	265	117
September	10,938	10,470	468	7,202	6.5	234	109
October	12,734	12,513	221	8,290	2.7	96	127
November 1–22	8,410	8,289	121	5,406	2.2	81	84
	$58,233	$56,274	$1,959	$38,522	5.1%	184	583

† Bosis: 74.11 cents per mile.
* Figure in thousonds

IV. Circumferential Service

A. Sullivan Square to Dudley Station

1. Description

a. Physical Setting

This new Inner Circumferential route ran from Sullivan Square to Dudley Station at a radius of three miles from downtown Boston. The route passed through seven rail transit stations while traversing eight congested residential and retail communities. This route made possible a single 10¢ ride between many intermediate points which was previously possible only with change of vehicle or by riding downtown on one rapid transit radial and out on another rapid transit radial, and frequently the additional use of a local bus.

b. Purpose

The purpose of this experiment was to test the effects provided by a new circumferential service operating at a radius of three miles from the core of the major city of a major urban region.

c. Experimental Changes

This new service provided 10 minute frequency during peak periods and 15 minute frequency during off-peak periods on weekdays. The length of the route was 8.7 miles, with running time scheduled at 45 minutes. The experiment began on June 22, 1963 and concluded on November 27. 1963

A revenue base consisting of revenues from all parallel MTA bus service for the corresponding months of the previous year was established for both control and contract payment purposes.

2. Results

The average number of additional riders gained by this service on a typical weekday fluctuated widely between 800 in July and 1200 in August, dropping to 400 in September, climbing again to 700 in October and declining to 600 in the final month of November.

Except for the unusual month of August, the ratio of increased revenue to incremental (contract) cost carried between 3.4 per cent and 6.2 per cent for an average for the entire experimental period of 4.3 per cent.

B. Outer-Circumferential: Phase One: Ashmont Station to Harvard Square

1. Description

a. Physical Setting

This new outer circumferential route, the longest of the MTA experiments, ran from Ashmont to Harvard Square at a radius of five miles from downtown Boston. The route passed through seven rail transit stations while traversing an equal number of residential communities. This route made possible a single 10¢ ride between many intermediate points. which had previously been possible only with change of

TABLE 63

MTA ROUTE E–3: INCREASED SERVICE, DUDLEY STATION TO SULLIVAN SQUARE VIA HARVARD SQUARE.

Period	Revenue Corridor 1963	Revenue Corridor 1962	Rev. Increase	Gross Contract Costt	Rev. Incr/Cost	Incr/Doy	Total Possengers Corried
June 24–30, '63	$ 15,917	$ 15,665	$ 254	$ 5,981	4.2%	507	159,190
July	63,023	61,921	1,102	26,315	4.2	501	630,230
August	64,064	61,341	1,724	26,226	10.4	1238	640,640
September	66,506	65,713	793	23,532	3.4	397	665,060
October	79,996	78,314	1,682	26,942	6.2	731	799,960
November 1–22	52,444	51,547	907	17,343	5.2	601	524,440
6/24–11/22/63	$341,952	$334,496	$7,458	$126,340	4.3%	697	3419,520

† Bosis: 88.05 cents per mile

TABLE 64

MTA ROUTE E–5: NEW SERVICE:
ASHMONT TO HARVARD SQUARE †

Period	Corridor Rev.†† 1963	Corridor Rev.†† 1962	Revenue Increase	Gross Contract Cost†††	Rev. Incr/Cost	Rider Incr/Day	No. of Possengers
1963							
June 24–30	$ 5,666	$ 4,943	$ 723	$ 8,610	8.4%	1,446	56,660
July	24,188	18,842	6,346	37,816	16.8	2,884	257,880
August	26,431	19,455	6,976	37,792	18.5	3,171	264,310
September	33,173	26,916	6,257	34,299	18.2	3,128	331,730
October	40,114	32,462	7,652	39,470	19.4	3,327	401,140
November	33,408	27,299	6,109	31,920	19.1	3,879	334,080
December 1–27	36,145	27,908	8,237	31,194	26.4	4,335	361,450
6/24–12/27/63	$200,126	$157,825	$42,300	$221,101	19.1	3,347	2001,250

† Evening rush period service reduced 11/25/63.
†† Revenue includes that from existing, overlopping routes, to ollow for any diversion.
††† Bosis: 71.48 cents per mile 6/24–11/22/63
73.00 cents per mile 11/25–12/27/63

vehicle or by riding downtown on one radial and out on another.

b. Purpose

The purpose of this experiment was to test the effects provided by a new circumferential service operating at a radius of five miles from the core of the major city of a major urban region.

c. Experimental Changes

This new service provided 10 minute frequency during peak periods and 15 minute frequency during off-peak periods on weekdays. The length of the route was 15.5 miles and its running time was scheduled at 64 minutes. The experiment began on June 22, 1963 and was concluded on December 27, 1963.

2. Results.

The average daily ridership increased steadily from 1400 in the first week of the experiment to 4300 in the final month of December. Similarily the ratio of revenue increase to incremental (contract) cost had a steady pattern of increases from 8.4 per cent to 26.4 per cent.

C. Outer-Circumferential: Phase Two: Ashmont Station to Reservoir Station

1. Description

a. Physical Setting

A clear ridership pattern had been developed in the first phase of this outer circumferential experiment, demonstrating that 93 per cent of the revenue collected was obtained over the portion of the route between Ashmont Station and Reservoir. In addition traffic congestion in the Harvard Square area had created considerable difficulties in the maintenance of schedules.

b. Purpose

The purpose of the second phase of the outer circumferential experiment was to test the effects of adjusting the service pattern of the experiment in the light of the pattern of public patronage and a more efficient utilization of manpower and equipment.

c. Experimental Changes

Frequency of the first phase, 10 minutes during peak periods and 15 minutes during off-peak periods, was continued. The route length was shortened from 15.5 miles to 11.4 miles and the running time corresponding was reduced from 65 minutes to 48 minutes.

During the peak period additional trips were operated between Ashmont and Forest Hills, an intermediate point on the circumferential route which connected with a major rapid transit radial, maintaining substantially the same frequency of service. The second phase of the outer circumferential experiment began on December 28, 1963 and was concluded on March 27, 1964.

2. Results

After the adjustments had been made in the length of the route, ratio of incremental revenue to incremental (contract) cost rapidly increased from the 26.4 per cent in the last part of the first phase of 40.8 in January 1964 and 41.5 in February, with a decline to 34.4 in March. Similarly the average daily increase in ridership was steady for the first two months but declined in March.

V. Local Peak Bus Service Parallel to Transit

A. Kenmore Square to Boston College via Commonwealth Avenue

1. Description

a. Physical Setting

The MTA has long operated a PCC trolley line from the underground subway of downtown Boston, emerging to the surface at Kenmore Square and continuing on the surface in a center strip along Commonwealth Avenue, terminating just below the Boston College campus in Newton.

With the introduction of the zone fare system in the Fall of 1961, the running time of this particular route was increased to accommodate the frequent transactions involved in the purchase and redemption of warrants by local riders on points covered in the surface operation. The subway

TABLE 65

MTA ROUTES E–6 and E–6[2]
ASHMONT TO RESERVOIR AND ASHMONT TO FOREST HILLS

Period	Under Experiment	Yeor Ago	Rev. Increose	Contract Cost§	Rev. Incr/Cast	Rider Incr/Day	No. of Passengers
1963							
Dec. 30–31	$ 2,092	$ 1,473	$ 619	$ 1,612	37.8%	3,094	20,920
1964							
January	24,784	17,376	7,408	18,180	40.8	3,368	247,840
February	22,400	15,532	6,868	16,542	41.5	3,434	224,000
March 1–27	21,832	16,138	5,694	16,567	34.4	2,847	218,320
12/30/63 – 3/27/64	$71,108	$50,519	$20,590	$52,902	38.9%	3,217	711,080

§ Basis: 75.72 cents per mile E–6, Ashmant ta Reservair and thraugh bus service (85% of combined daily miles); 81.23 cents per mile for E–6[2]. Ashmant ta Forest Hills rush hour service (15% af combined daily miles).

surface combination fare was 30¢ and the local surface fare was 10¢.

MTA passenger counts indicated that there were more than 5,000 local riders on an average weekday between two points of the surface part of the operation of this line.

b. Purpose

The purpose of this experiment was to test the results of providing a through local peak hour bus service parallel to surface transit operations in an urbanized portion of the core city in a major urban region.

c. Experimental Changes

Parallel bus service operated only in the peak periods between 7 A.M. and 10 A.M. and 1:55 P.M. to 5:55 P.M. Monday through Friday. Both the bus and trolley service scheduled a five minute frequency. The bus trip was 4.9 miles in length, and had a running time of twenty minutes. The experiment began on September 1, 1963 and concluded on December 27, 1963.

2. Results.

Average daily ridership for both the transit and bus lines increased from 1300 in October to 2600 in November and 3600 in December.

The ratio of increased revenue to the incremental (contract) cost, which was based upon the operating costs for the bus miles actually operated, increased from 19.8 per cent in October to 43.8 per cent in December. During the first weeks of operation the MTC staff observed an apparent reduction in the running time of the PCC service. However, this gain evaporated as the experiment went on and the heavy travel period of November and December was reached.

3. Post Experimental Results

The MTA has maintained this experimental pattern in its entirety.

VI. Drive-In Theaters — Express Bus Service

A. Fresh Pond, Neponset, Revere

1. Description

a. Physical Setting

As with most urban areas in the United States, on several of the modern highway approaches to the downtown core in the Boston region there are several drive-in movie theaters located just outside the most heavily congested portions of these super-highways. These drive-in theaters have a vast capacity, usually well above one thousand parking spaces, and serve no economic purpose during the daytime hours, being completely unoccupied.

b. Purpose

The purpose of these three experiments was to test the results of providing low cost parking at drive-in theaters outside the areas of maximum traffic congestion, in conjunction with express bus service to the core of the city and rapid transit facilities.

TABLE 66

MTA ROUTE E–9: BOSTON COLLEGE TO KENMORE SQUARE PARALLEL SERVICE

Period	Revenue 1963	Revenue 1962	Revenue Increose	Grass Contract Cost	Rev. Inc. Cost	Rider Increase Day	No. of Passengers
September 3–30	$69,007	$68,227	$ 780	$13,143	5.9%	390	690,070
October	88,786	85,797	2,989	15,107	19.8	1,299	887,860
November	72,899	70,880	2,019	12,360	16.3	2,600	728,990
December 2–27	73,451	66,693	6,758	15,415	43.8	3,557	734,510
9/3/63 – 12/27/63	$304,143	$291,597	$12,546	$56,026	22.4%	1,901	3,041,430

Basis: 69.11 cents per mile 9/3 – 11/22/63
81.12 cents per mile 11/25 – 12/27/63

Assumes thot oll revenue increases under the experiment are attributable to local riders who poy o 10¢ fore.

TABLE 67

MTA ROUTE E–8:
FRESH POND DRIVE-IN TO HARVARD SQUARE

Period	Revenue	Grass Contract Castt	Revenue/Cast
September 3–30	$193.	$6,563.	2.9%
October	175.	7,548.	2.3
November	136.	6,030.	2.3
December 1–27	134.	6,067.	2.0
9/3/63 – 12/27/63	$628.	$26,209.	2.4%

†Basis: 85.52 cents per mile.

c. Experimental Changes

i. Fresh Pond Drive-In Theater to Harvard Square. Parking facilities were made available at the Fresh Pond drive-in theater, located at the confluence of two major arteries northwest of Boston (Route 2 and Concord Avenue). The length of the bus route was 1.8 miles and the new service provided five minute frequency in peak hours and 10 minute frequency in the off-peak hours, from 6 a.m. to 6 p.m., Monday through Friday. Running time was scheduled at 10 minutes. The combination parking fee and round trip fare totalled 55¢. The theater operator retained 25¢ of the combined fare as his parking fee. The experiment was begun on September 1, 1963 and concluded December 27, 1963.

ii. Neponset Drive-In Theater to South Station. From the Neponset Drive-In Theater, located on the Southeast Expressway, five minute frequency was provided for peak hours and 10 minute frequency in off peak periods from 6:30 a.m. to 6:30 p.m. Monday through Friday, from the beginning of the experiment on September 1, 1963 through December 27, 1963. For the remainder of the experiment, December 28 to the conclusion on March 27, 1964, frequency was 10 minutes for peak hours and 20 minutes in off-peak periods. The length of the bus route was 6.8 miles and running time was scheduled at 18 minutes. The combination parking fee and round trip fare totalled $1.00, of which the theater operator retained 25¢ as his parking fee.

iii. Revere Drive-In Theater to Haymarket Square. The Revere Drive-In Theater to Haymarket Square route was 7.1 miles with a running time of 15 minutes. Frequency was five minutes during peak hours and 10 minutes during off-peak hours, Monday through Friday from 6:30 a.m. to 6:30 p.m. The combination parking fee and round trip fare totalled $1.00, with the theater operator retaining 25¢ as his parking fee. The experiment began on September 1, and concluded on November 27, 1963.

2. Results

The total number of cars parked in one day in the three lots never reached 40, and the ratio of revenue to incremental (contract) cost never reached 6 per cent.

TABLE 68

MTA ROUTE E–10:
NEPONSET DRIVE-IN THEATER TO SOUTH STATION

Period	Revenue	Grass Contract Castt	Revenue /Cast
Phase One			
September 3–30	$512	$15,306	3.3%
October	748	17,647	4.2
November	691	14,038	4.9
December 1–27	590	14,559	4.0
9/3–12/27/63	$2,541	$61,550	4.1
Phase Two			
December 30–31	$	$ 890	
January	660	10,098	6.5
February	521	9,156	5.7
March 1–27	519	9,210	5.6
12/30/63–3/27/64	$1,700	$29,354	5.9

†Basis: 66.92 cents per mile, 9/3–12/27/63; 68.12 cents per mile, 12/30–12/31/63; 69.19 cents per mile, 1/2–3/27/64.

B. Reduced Parking Fees at Selected Rapid Transit Surface Stations

1. Description

a. Physical Setting

The MTA maintains parking facilities of varying sizes at 34 of its rapid transit stations, with a total daily capacity of approximately 6,000 cars. The pre-experimental parking fee was fixed at 35¢. Prior to the experiment, these parking facilities had been only half utilized.

b. Purpose

The purpose of this experiment was to test the elasticity of parking lot demand at rapid transit stations by the selective reductions of parking fees at certain lots showing a comparatively low rate of utilization.

c. Experimental Changes

Parking fees were reduced from 35¢ to 10¢ at eight locations. The experiment was begun on April 1, 1963 and concluded on February 12, 1964.

2. Results

The downward trend in utilization of MTA parking lots was reversed and a 60 per cent net increase in the number of cars parked at all parking lots occurred.

The loss in parking revenue from the reduced parking fees was more than offset by the increase in fare box income from new ridership. The MTC staff determined by field observation that each additional car parked represented 1.3 new riders. A total of 1,200 cars had been added to MTA parking lots on a daily average basis at the close of the experiment.

A detailed statistical presentation of the results of this parking experiment is included as Appendix B of this Report.

3. Post Experimental Results

The MTA trustees changed their basic policy toward the pricing of their parking lot fees as a result of this experi-

TABLE 69

MTA ROUTE E-11:
REVERE DRIVE-IN TO HAYMARKET SQUARE

Period	Revenue	Gross Contract Costt	Revenue /Cost
September 3–30	$188	$15,325	1.4%
October	172	15,210	1.1
November 1–22	84	9,984	0.8
9/3–11/27/63	$444	$38,519	1.2%

tBasis: 56.20 cents per mile.

ment. A sliding schedule was established, adjusting the price at each lot to the utilization of the lot. The new parking policy is expected to yield an additional $200,000 a year in net revenue for the MTA.

VII. Findings

1. Downtown Distribution

Increases in frequency in local service completely within the downtown district of a major urban regional center can be self-sustaining.

2. Increased Off-Peak Suburban Bus Feeder Service

Increased off-peak suburban bus feeder service through a low density residential area to a rapid transit terminal with frequency increased from ten to five minutes, produced no appreciable increase in ridership.

3. Circumferential Service

In the major city of a major urban region, as distance from the city center increases, circumferential bus service becomes more attractive to a larger number of people. More precisely, as the distance from downtown increases, traffic congestion decreases, permitting higher bus operating speeds. In addition, as distance from downtown increases, the time required to travel downtown on radial rapid transit and back out to the perimeter on another radial transit line increases while, for a given length of journey, the bus travel time decreases until a point, apparently about five miles from the downtown core, when circumferential bus service becomes faster than rapid transit for many destinations.

4. Drive-In Theater Parking and Express Bus Service

The combination of parking at Drive-In Theaters on the fringes of the core city of a major urban area and express bus service direct to downtown and rapid transit terminals produced no appreciable ridership.

5. Parking at Rapid Transit Station

Reduction of parking fees at rapid transit stations with substantial parking vacancies results in substantial increases in both ridership and net revenues for the transit operator.

Chapter Seven

Market Surveys

I. MTC Staff Surveys

During the course of each demonstration experiment regular checks were made by members of the MTC field staff to assure that all scheduled services purchased were performed in compliance with contracts. In addition, the same field personnel carried out market surveys consisting of interviews with patrons on Demonstration Project services.

Basic data concerning passengers' age, sex, purpose of trip, etc. was gathered for each route. However, interviews were constructed to place primary emphasis on gaining an insight into the habits and opinions of riders, their feelings about public transportation, and their reasons for preferring one mode over another.

A. Riders Using Reduced Fare Off Peak Service

1. Lowell — Eastern Massachusetts Street Railway

A passenger survey was conducted by MTC personnel on buses in Lowell on Tuesday, February 26th through Friday, March 1, 1963.

The experimental off-peak fare reduction from 25 cents to 10 cents within a 1.5 mile radius of downtown Lowell attracted new bus riders to the extent of 14.9 per cent of those sampled, most of whom previously had driven autos or walked and some who had used car pools or taxis. More significant was the fact that 63 per cent of the regular. previous riders indicated that they rode more frequently during the experiment.

a. Characteristics and Habits of Riders

Three rider characteristics were established: 69 per cent of all riders were female; over 50 per cent were on shopping trips; and 70 per cent of the riders were over 40 years old.

Most new riders had either walked or driven autos before the experiment. Of the regular riders, two-thirds rode at the same time of day. Two-thirds also rode more often.

Over 50 per cent of the riders used the bus daily, 26 per cent weekly and 20 per cent occasionally. Over 50 per cent walked only one block to the bus and almost 90 per cent of all riders lived within two blocks of the bus. Half were on shopping trips but one-fourth were going to work; shopping and working are the reasons for riding the bus for over 75 per cent of the riders. Medical, entertainment and miscellaneous trips account for less than 10 per cent of all trips.

Since the MTC survey indicated that most of the increase in passenger volume was derived from increased automobile riders, the interviews indicated that the experiment may have added a maximum of 100 to 150 shoppers to the estimated 12,000 shoppers in downtown Lowell on a typical shopping day, or a maximum possible increase in retail volume of little more than one per cent.

2. North Shore — Eastern Massachusetts Street Railway Company

In October, 1963 a passenger survey was conducted by MTC personnel on all Eastern Mass. routes from suburban

Table 70

EASTERN MASSACHUSETTS STREET RAILWAY COMPANY

Reduced Off-Peak Fare Experiment
Summation of Survey (Expanded to 100%)

	Haymarket Square to:				Park Square to:				Total	
	Marblehead 30% Sample		Salem 45% Sample		Lowell 57% Sample		Lawrence 50% Sample		Totals	
1. Sex										
Male	247	34%	121	53%	72	40%	28	34%	468	38.2%
Female	478	66	107	47	108	60	54	66	756	61.8
									1,224	100.0%
2. Age Range										
Under 20	51	7%	20	9%	16	9%	0	0%	87	7.7%
20–40	174	24	73	32	49	27	14	17	210	25.5
41–65	413	57	103	45	90	50	58	71	664	54.7
Over 65	87	12	32	14	25	14	10	12	154	12.7
									1,215	100.0%
3. Prior Use of Bus										
Yes	528	73%	182	80%	126	70%	New		836	73.9%
No	196	27%	46	20%	54	30%	Service		296	26.1
									1,132	100.0%
4. No Former Mode of Travel										
1. Car	102	53%	21	45%	22	40%	26	32%	171	45.2%
2. Train	94	47	4	10	32	60	46	56	176	46.6
3. New Trip			21	45					21	5.6
4. Bus							10	12	10	2.6
									378	100.0%
5. Frequency										
Daily	340	47%	105	47%	104	58%	6	7%	555	45.7%
Weekly	202	28	59	26	40	22	28	34	329	27.1
Occasionally	182	25	64	27	36	20	48	59	331	27.2
									1,215	100.0%
6. Travel to Destination MTA										
Bus	81	12%	20	9%	18	10%	28	21%	147	11.6%
Subway	67	9	31	13	29	16	16	12	143	11.3
Walk	545	75	164	72	124	69	82	63	915	72.3
Taxi	24	3	5	2	11	5	6	4	46	3.6
Car	8	1	9	4	0	0	0	0	17	1.2
									1,224	100.0%

Note: Totals in questions 2 to 5 are less than total 1,224 persons interviewed in cases where same questions were not answered by all persons interviewed.

North Shore communities to downtown Boston.

The North Shore experiment involved an off-peak fare equal to that charged on competitive B&M routes. This fare was about 30 per cent lower than that charged in the peak periods. Prior to the experiment the peak hour fare was charged all day, everyday.

The purpose of the survey was to determine the percentage increase in new passengers and to find out how the new riders previously traveled to Boston.

As shown in the table below, 47 per cent of the new passengers were diverted from the train when there was no fare competition. At the same time, 45 per cent of the new passengers were diverted from automobile travel.

B. Downtown Distribution Routes — Boston

1. North Station-MIT (MTA)

The age statistics gathered by the interviews show that few, if any, MIT students found this new service convenient.

Apparently about 60 motorists were induced to leave their cars at home by this service. At the same time, 59 per cent of the riders previously used some other MTA route to make this trip. Passengers were also asked to name their home community. 199 (50 per cent) named Cambridge or Boston, while 202 (50 per cent) named one of thirty-three cities or towns located along B&M commuter lines. It was apparent that a majority of passengers were not MIT students, but workers at nearby industries.

Data compiled from interviews with passengers on this route is summarized in the following table.

Total Passengers		401	
Total Interviews		257 or 65%	
Figures shown are projected to 100%			
Sex:	Male	232	58%
	Female	169	42%
Age:	Under 20	0	
	20-40	224	56%
	40-65	132	33%
	Over 65	45	11%

"How did you make this trip before the introduction of this experimental route?"

Other MTA Route	236	59%
Car	60	23%
Taxi	5	2%
Walk	45	11%

"How often do you use this experimental bus?"

Frequency of Use:		
1 day week	64	16%
2-3 day week	41	10%
4-5 day week	296	75%

"Is this route used for train connection?"

Yes	236	59%
No	162	41%

"Did you use B&M train in 1962?"

Yes	96	24%
No	300	76%

If no, "How did you make this trip last year?"

Car	85	28%
Bus	105	35%
No Reply	70	23%
Car Pool	40	14%

"Did this route start you using train?"

Yes	124	31%
No	276	69%

2. North Station-South Station (MTA)

Passenger characteristics on this route were found to be as follows:

Total Passengers		1070	
Total Interviews		370 or 35%	
Figures are projected to 100%			
Sex:	Male	552	51%
	Female	518	49%
Age:	Under 20	9	1%
	20-40	564	53%
	40-65	484	45%
	Over 65	14	1%
Purpose of Trip:			
	Work	833	78%
	Shopping	58	5%
	School	14	1%
	Recreation	50	5%
	Visit	61	6%

Mode of travel prior to introduction of the experimental service.

MTA	723	67%
Car	81	8%
Walk	191	18%

The high proportion of persons who formerly walked is discussed below.

Times per week trip is made.		
1 day week	49	5%
2-3 day week	32	3%
4-5 day week	915	86%
Is train connection made?		
Yes	353	96%
Did you use train in 1962?		
Yes	300	81%
No	53	15%

The North Station-South Station bus route is one mile in length, connecting Boston's two railroad terminals via the downtown business district. From the downtown business district to either railroad terminal is a ten-minute walk, and during rush hours large numbers of hardy Bostonians walk to and from each terminal. Moreover, a large number of persons circulate in this area throughout the entire day. The previous North Station headway of 25 minutes may have

attracted little or no patronage because one could frequently walk to either train station before a bus was available. In contrast, on a five-minute headway, buses are visible nearly continuously and apparently attract many "impulse" riders, among whom are the 191 persons interviewed who previously walked.

C. Circumferential Bus Routes MTA

Two bus routes designated the Inner and Outer Circumferential Routes circled Boston at a radius of three and five miles respectively.

1. On the Inner Circumferential Route, interviews were completed with 756 riders.

Total Passengers		5000	
Total Interviews		756 or 15%	
Figures shown are projected to 100%.			
Sex:	Male	2500	52%
	Female	2400	48%
Age:	Under 20	0	
	20-40	1450	29%
	40-65	3300	66%
	Over 65	220	4%
Purpose of Trip:			
	Work	2700	54%
	Shopping	500	10%
	School	150	3%
	Recreation	250	5%
	Visit	850	17%
"How often do you use this experimental bus?"			
	1 day week	350	7%
	2-3 day week	950	19%
	4-5 day week	3160	63%
"Did you ride another bus along this route last Spring?"			
	Yes	3800	76%
	No	1200	24%
If "No", "What was your previous method of travel?"			
	Another MTA Service	900	75%
	Car	190	16%
	Walk	72	6%
	New Rider	24	2%

From this, it can be seen that only 286 new passengers were attracted by this service.

"How far is it from your house to the bus stop?"			
	One block or less	2550	51%
	Three blocks or less	4300	86%
	Five blocks or less	4650	93%
			(Cumulative)

This last question revealed the strictly local origin of passengers on this crosstown bus service. For passengers walking to the bus stop, a five block radius encompasses all but seven per cent of those who use this service.

2. Outer Circumferential Bus Route

Total Passengers		5200	
Total Interviews		846	
Figures shown are projected to 100%.			
Sex:	Male	2340	45%
	Female	2860	55%
Age:	Under 20	260	5%
	20-40	1250	24%
	40-65	2560	49%
	Over 65	1200	23%

Of people interviewed, 90 per cent walked from their home to the bus stop.

Purpose of Trip:			
	Work	3280	63%
	Shopping	364	7%
	School	418	8%
	Recreation	364	7%
	Visit	780	15%

Of people interviewed

13 per cent or 340 people formerly used their car for trip which they now make on the bus.

44 per cent or 1150 people formerly used other buses operating over the same route.

43 per cent or 1120 people formerly traveled to Park Street and then traveled outbound on another rapid transit or streetcar line.

Of people interviewed only

8 per cent or 208 people travelled between Reservoir and Harvard Square, a distance which is 23 per cent of the route; 92 per cent of the fares were collected over 77 per cent of the route.

The data assembled on the Inner and Outer Circumferential bus routes suggest a general finding: As distance from the city center increases, circumferential bus service becomes more attractive to a larger number of people. This is true for two reasons. First, as the distance from downtown increases, traffic congestion decreases, permitting higher bus operating speeds. Second, as distance from downtown increases, the time required to travel downtown on rapid transit, and back out to the perimeter on another transit line increases while, for a given length of journey, the bus travel time decreases until a point, apparently about five miles from downtown Boston, when circumferential bus service becomes faster than rapid transit for many destinations.

The portion of the Outer Circumferential Route from Reservoir to Harvard Square which developed a lesser increase in patronage is precisely that portion where the route becomes less than five miles from Boston as it approaches Harvard Square, three miles from downtown.

D. Bus Service Paralleling An Established Subway-Surface Car Route — MTA

A bus route was established between Boston College and

Kenmore Square paralleling the existing PCC Car route between Boston College and Park Street. The added bus service permitted elimination of a complicated zoned fare structure on the car line, and greatly increased the number of seats available between Kenmore and Boston College.

Interviews with passengers permitted a partial measure of the mode of travel preferred:

		Size of Sample
Total Passengers	3600	
Total Interviews	1039	30%
Figures shown are projected to 100%		
	Passengers	%
Sex: Male	1470	41%
Female	2130	59%
Age: Under 20	610	17%
20-40	1365	38%
40-65	1505	42%
Over 65	110	3%
Purpose of Trip:		
Work	1980	55%
Shopping	252	7%
School	1100	30%
Recreation	—	—
Visit	278	8%
Mode of travel prior to introduction of experimental service.		
MTA	3060	86%
Car	254	7%
Walk	146	4%
"Which service do you prefer?"		
Bus	3450	96%
PCC	110	3%
No Preference	36	1%

It should be borne in mind that these interviews were made on board the buses. Interviews with street car riders would presumably produce different results.

"If bus is preferred, why?"		
Speed	1115	31%
Comfort	278	8%
More Seating	2052	57%
No Warrant	110	3%
"Do you feel MTA services are faster since the introduction of this bus service?"		
Yes	3356	93%
No	254	7%

The answers reveal the importance placed by patrons on the availability of seating as well as their belief that elimination of warrants has speeded up MTA services.

E. MTA: Combined Bus Interview Tabulation

A combined summary of interview results by the MTC staff for all MTA experiments is presented in Table 71. This comparison confirms that downtown oriented routes attract primarily adult male riders traveling five days a week to work, while suburban routes have a higher proportion of mature women riders who ride two or three days per week to go shopping or visiting. In addition, routes located in school and university areas outside the core city, naturally have a moderate proportion of student riders.

TABLE 71

RESULTS OF INTERVIEWS OF PASSENGERS ON SIX MTA EXPERIMENTAL ROUTES.

Sex:	E–2	E–3	E–4	E–5	E–7	E–9
% Female	42	48	50	55	49	59
Age:						
% Under 20	0	0	7	5	1	17
% 20-40	56	29	40	24	53	38
% 40-65	33	66	51	59	45	42
% Over 65	11	4	2	23	1	3
Purpose of Trip						
% Work	Not included in survey	54	66	63	78	55
% Shopping		10	18	7	5	7
% School		3	7	8	1	30
% Recreation		5	2	7	5	—
% Visit		17	4	15	6	8
Mode of travel prior to the introduction of the experimental service.						
% MTA	59	75	88	86	67	86
% Car	23	16	8	14	8	7
% Walk	11	6	2	—	18	4
Times per week trip is mode						
% Once a wk.	16	7	8	Not included in survey	5	Not included in survey
% 2-3 days/wk.	10	19	15		3	
% 4-5 days/wk.	75	63	77		86	

Note: E–2 North Station–MIT
E–3 Inner Circumferential Route
E–4 Elm Street (Medford) – Sullivan Square
E–5 Outer Circumferential
E–7 North Station–South Station
E–9 Boston College–Kenmore

F. Rapid Transit Parking Lots

A program of reducing parking fees from 35¢ to 10¢ at eight MTA parking lots having substantial vacancies was successful in increasing the daily average number of cars parked at MTA "Park and Ride" facilities by 1200 cars over a twelve month period.

1. Interviews with Patrons at "Park and Ride" Stations

In late May and early June of 1963, MTC staff members conducted extensive survey-interviews at each of the eight demonstration parking lots. More than ten per cent of the daily "park and ride" partons were interviewed along with a roughly equal sample of persons arriving at the stations by bus and on foot. Interview results were divided into "peak" or rush hour commuters, and "off-peak" with 9:30 a.m. set as the peak limit for inbound passengers.

As a result of this survey it was possible to develop a profile of the typical peak hour and off-peak hour user of MTA parking lots.

The typical inbound rush hour "park and ride" commuter is a male, who drives about four miles to an MTA parking

lot. He uses the parking lot Monday through Friday, his destination is downtown Boston, and he is on his way to work.

The typical off-peak hour MTA parking lot patron is a female, who drives about three miles to an MTA parking lot. She uses the parking lot about one day a week, her destination is downtown Boston and she is on a shopping trip. On the Revere line, there is also a pattern of "park and ride" commuting by men working in downtown Boston on shifts other than the usual nine to five pattern.

The survey also covered commuters arriving at MTA stations by bus and on foot. A similar pattern of men traveling downtown to work, and women traveling downtown for shopping is indicated. "Walk-in" passengers in the sample walked four blocks to the station, on the average.

In terms of distance traveled to MTA parking lots, the average reported by parkers at Riverside was higher than at other lots; off-peak patrons at the Riverside lot drove an average of ten miles to the lot with definite groupings at seven and ten miles, indicative of substantial patronage from the Wellesley and Framingham areas.

2. License Plates at MTA Lots

Almost a year later, in March 1964, MTC field staff workers sought another index of the origins of MTA patrons using MTA "Park and Ride" facilities. During five consecutive week days, MTC field workers recorded the license numbers of 4812 cars at MTA parking lots. This represents a 100 per cent samble of the cars using the 34 MTA parking locations included in this survey.

License numbers collected in this manner were collated and compared with the records of the Massachusetts Registry of Motor Vehicles in order to determine the community where the owner resided. The results are plotted on the accompanying maps grouped by lines according to the location of the parking lots:

East Boston Line
Riverside Line
Mattapan Line
System Total

The maps showing the origins of cars parked along each of these lines show that these cars came from clearly defined sectors of the Greater Boston "Hub", with the majority of the cars, in numerical terms, grouped near the outer end of the rapid transit lines serving each sector.

The cars parked at *all* MTA parking lots are shown on Map 20. This map tends to show the rather large scope of the area served by the present MTA. Cars from a total of 182 Massachusetts cities and towns were found parked at MTA facilities within the fourteen cities and towns of the MTA district.

3. Downtown Private Garage Parking

By way of comparison, the origins of 5673 automobile commuters who parked their cars in off-street parking garages downtown was also traced by the same method: tracing license numbers to their town of origin. Again, as shown in Map 24, the large size of the eastern Massachusetts area focused on downtown Boston was emphasized. Cars were found from a total of 240 Massachusetts communities, representing nearly all of the Eastern half of the state.

G. B&M Passenger

In March 1963 the MTC conducted a survey of B&M passengers from several key stations to determine how the new rail riders formerly travelled to Boston. This survey, which was based on a small sample, indicated that 83 per cent of the new passengers formerly drove or rode in a car pool to Boston, while only 17 per cent came by bus.

The MTC survey permitted the passengers interviewed a chance to express his reasons for switching modes of transportation. Of those diverted from bus 67 per cent said they were riding the B&M because of service. In the off-peak hours only 23 per cent of the former bus riders changed to train because of fare considerations. In the peak period, however, 50 per cent of the former bus riders were influenced by fare.

Comments suggested that the service offered rather than the fare was of prime consideration to most of the old and new rail riders. Those who switched from bus often commented on "undependable" bus service and were now happy they could depend upon the train to get them to Boston at a specific time.

As a consequence of the MTC staff survey it was decided to retain the firm of Joseph Napolitan Associates to conduct a more comprehensive survey with a large sample of the total ridership.

II. First Napolitan Survey of B&M Riders (April, 1963)

The results of the staff survey of B&M riders indicated the desirability of retaining a recognized firm of specialists in public opinion sampling to determine more precisely the travel patterns of the B&M passengers.

A. Goals

The object of this survey was to determine the habits of commuters and other train riders on various B&M lines, and to determine what changes had occurred in commuting practices as a result of the experiment.

Specifically, the survey sought to determine:

— The number of new commuters attracted since implementation of the MTC plan increasing service and lowering fares.

— How new riders previously traveled to Boston.

— What effect, if any, increased train commuter service had on other forms of mass transportation service.

— What form of public transportation, if any, commuters used to reach their eventual destination when they arrived in Boston.

— What form of transportation, public or private, commuters used to get from their homes to the train station in order to board a commuter train to Boston.

B. Scope

To obtain the information required to report comprehensively on the commuting habits of Boston & Maine train riders, interviews were conducted:

— With 9825 commuters and other train riders.

— On 116 separate trains from Monday, April 22, through Saturday, April 27. 105 of these trains operated during the day, arriving in Boston between 7:30 a.m. and 5:45 p.m., on week-days. 9 trains surveyed operated on Saturday, between these same hours, and 2 were evening trains.

— Of the 9825 interviews, 9271 were conducted with weekday riders, 535 with Saturday riders, and 19 with evening riders.

— 7 lines were included in this survey. These lines were:

New Hampshire District (Lowell, Woburn, Winchester)	1879 interviews
Western Route (Haverhill)	1253 interviews
Reading Line (Reading, Melrose Highlands)	2738 interviews
Fitchburg Division (Fitchburg, South Acton)	1008 interviews
Eastern Route (Rockport, Beverly, Newburyport)	2615 interviews
Bedford Line (Bedford)	170 interviews
Hudson Line (Hudson)	162 interviews
Total	9825 interviews

— A total of 29 interviewers and two supervisors were used to obtain the information necessary to this survey. Interviews were conducted only on in-bound trains, and the usual method of interviewing procedure was this: Interviewers would board the train at the point of origin (except interstate trains which were boarded at the first Massachusetts station) and distribute to all riders a questionnaire. One side of the questionnaire carried a request for commuter assistance; the other carried the actual questions. One interviewer was assigned to each railroad car, and circulated through the car, assisting commuters who needed assistance, and collecting the questionnaires when they were completed. Conductors on the railroad had been informed of the survey and were cooperative with and helpful to the interviewers. Attempts were made to obtain interviews with every rider, but, not unexpectedly, this proved impossible because some riders refused to answer the questions. The number who refused to answer was estimated at approximately 5 per cent, and did not affect the validity or the accuracy of the sampling.

C. Results

1. Usage

The survey revealed that:

25.5 per cent of all riders interviewed said they were riding the train *more often* than they were prior to implementation of the current plan.

71.7 per cent said they were riding the train the *same number of days per week* as they were before.

2.8 per cent said they were riding the train *less often* than were before.

2. Previous Means of Transportation

Riders who used the trains more often were then asked what method of transportation they previously had used to get to Boston. These were the overall responses, based on all interviews:

66 per cent said they had used their *own car* to drive to Boston.

19 per cent said they had been members of a *car pool.*

15 per cent said they had used the *bus* to get to Boston.

The obvious finding drawn from these responses was that 85 per cent of *all new train riders previously commuted to Boston by car.*

3. Getting to the Station

All persons interviewed were asked this question: "How did you get to the station today to catch this train?" Here are the gross responses:

42.3 per cent drove their *own car, parked it at the station.*

28.1 per cent *walked.*

2.5 per cent *took the bus* to the station.

4.3 per cent *took a taxi* to the station.

21.2 per cent *were driven to the station by a member of their family.*

1.6 per cent got to the station as part of a *car pool.*

Thus, nearly 63 per cent of all commuters got to the station in their own car, with 42.3 per cent driving themselves and leaving the car, and 21.2 per cent being driven by their wife or other member of the family who then presumably had use of the family car throughout the day. Walking was next only to using the family car as a means of getting to the station, with 28.1 per cent — or about 1 commuter in 4 — getting to the station by foot. Taxis (4.3), busses (2.5), and car pools (1.6) were well down the list, but it is interesting to note that twice as many persons went to the station by taxi as by bus. Moreover, nearly four times as many persons took a taxi on Saturday as during the week.

Method	Week-day	Saturday
Own car, parked at station	42.3	25.4
Walked	28.1	30.4
Bus	2.5	4.2
Taxi	4.3	15.6
Driven to station by member of family	21.2	23.6
Car pool	1.6	.8

4. Reaching the Eventual Destination

All riders were asked how they reached their eventual destination when they arrived in Boston. Here are the results:

44.1 per cent *walk.*
37.7 per cent use the *MTA subway.*
10.1 per cent use the *MTA bus.*
5.4 per cent use a *taxi.*

On Saturday, perhaps because these were non-business riders who may have been traveling to more remote sections of the city, the number of MTA subway riders almost doubled, and the number who walked to their destination was reduced by half. Here are the comparisons:

Method	Week-day	Saturday
Walk	45.5	20.2
MTA subway	36.1	66.2
MTA bus	10.5	3.0
Taxi	5.2	7.1

5. Peak and Off-Peak Differences

The survey results were anaylzed to determine the differences, if any, between commuter habits of train riders during the peak hours (before 9:30 a.m.) and off-peak hours (after 9:30 a.m.) Saturday and evening trains were excluded from this comparison.

It should be noted that five times as many interviews were conducted with riders during peak hours than were conducted with riders during peak hours than were conducted in off-peak hours; the totals are 7601 in peak hours, 1656 in off-peak hours.

There were some significant differences in commuter habits between peak and off-peak riders.

a. Previous Method of Transportation

Among both groups, the chief previous method of transportation to Boston was the automobile. On a percentage basis, more of the off-peak riders formerly took the bus instead of the train. Here are the figures:

	Peak	Off-Peak
Own car	57.6	50.1
Car Pool	17.4	9.2
Bus	10.2	18.2
No answer	14.8	22.5

b. Getting to the Station

The most significant difference here between peak and off-peak was this: 19.8 per cent of off-peak riders took a bus (7.1) or taxi (12.7) to the station to catch a train, while only 4.3 per cent of peak riders used the bus (1.8) or taxi (2.5).

More off-peak riders walked to the station, fewer were driven to the station by a member of the family. Here are the tabulations:

	Peak	Off-Peak
Own car, parked at station	43.7	30.9
Walked	26.4	33.1
Bus	1.8	7.1
Taxi	2.5	12.7
Driven to station by member of family	22.3	12.9
Car pool	1.8	.5
No answer	1.5	2.8

c. Reaching Eventual Destination in Boston

Twice as many peak-hour riders walk to their eventual destination after arriving in Boston by train; substantially more off-peak riders use the subway to reach their eventual destination. And twice as many off-peak riders take a taxi to their destination. Here are the figures:

	Peak	Off-Peak
Walk	50.2	24.5
MTA Subway	32.5	52.5
MTA Bus	11.3	7.2
Taxi	4.0	10.1
No answer	2.0	5.7

D. Summary and Findings

1. 25.5 per cent of all riders interviewed said they were riding the train *more often* than they were a year ago.

2. 85.0 per cent of these new riders *previously commuted to Boston by automobile.* Only 15 per cent were former bus riders.

3. 63.0 per cent of all riders interviewed went to their local station in their own car — 42.3 per cent leaving the car at the station, and 21.2 per cent being driven to the station by another member of their family.

4. Nearly half of the riders interviewed *walked* to their eventual destination after they reached Boston, and more than one-third used the MTA subway.

III. Second Napolitan Survey (November, 1963)

The principal purpose of the second Napolitan passenger survey was to obtain the names and addresses of potential respondents for an in-depth interview designed to determine the factors which influence the public's choice of mode of transportation.

The secondary purpose of this survey was to gather certain basic facts about transportation habits of passengers using MTC experimental services of the B&M, New Haven, MTA and private bus companies. As the questions asked on the survey were the same as for the first Napolitan survey in April 1963, the results of each are comparable in respect to B&M passengers.

A. Trains

1. Goals

The following information on train users for the purposes

of this preliminary survey was sought:

The number of new commuters attracted since the start of the Mass Transportation Commission experiments.

Whether increased services or lower fares was the more important factor in attracting new riders and what additional factors contributed to any increase in patronage.

How new users previously traveled to Boston.

What effect, if any, increased train commuter service had on other forms of transportation.

What form of transportation train riders used to get to the station from their homes.

What form of public transportation, if any, commuters used to reach their eventual destinations in Boston after leaving the train.

How the information concerning the B&M Railroad contained in this report compares with the results of an earlier survey on the B&M conducted by this firm for the Mass Transportation Commission in April, 1963.

2. Scope

Interviews were conducted with riders on both B&M and New Haven Railroad trains. Interviews were conducted only on in-bound trains. Interviewers would board the train at the point of origin (except interstate trains which were boarded at the first Massachusetts station) and distribute to all riders a card containing a questionnaire and a request for co-operation in completing the questionnaire. One interviewer was assigned to each railroad car, and circulated through the car, assisting riders who needed help, and collecting the completed questionnaires. Conductors on both railroads had been informed of the survey and were co-operative and helpful. Attempts were made to obtain interviews with every rider, but, as was anticipated, some riders refused to answer the questions. The number who refused to participate is estimated at 3 per cent and does not affect the validity of the sampling or the accuracy of the responses.

3. Results

a. Usage

The first objective was to determine whether riders were using the trains more, or less often than they did 12 months before the interviews were conducted.

The responses follow:

	Apr. 63 B&M only	Nov. 63 All riders	Nov. 63 B&M only	Nov. 63 NH only
Using trains more often	25.5%	22.9%	27.6%	19.1%
Same number of days	71.7	73.9	69.0	77.9
Using trains less often	2.8	3.2	3.4	3.0

The most significant results were these:

The number of B&M riders who said they are using the trains more often has increased since the previous survey from 25.5 per cent to 27.6 per cent. Slightly more B&M riders also reported they were using the train less often.

While 27.6 per cent of B&M riders said they were using the trains more often now than they were 12 months ago, only 19.1 per cent of New Haven riders said they were using the trains more often.

b. Previous Means of Transportation

Passengers who had stated that they were new riders were asked what method of transportation they had previously used to get to Boston.

Previous Method	Apr. 63 B&M only	Nov. 63 All riders	Nov. 63 B&M only	Nov. 63 NH only
Used own car	66.6	63.6	66.0	60.4
Member of car pool	18.5	16.9	18.9	14.3
Used bus	14.9	19.5	15.1	25.3

A comparison between April and November B&M riders revealed an almost identical percentage breakdown regarding the methods previously used by these commuters to travel back and forth to Boston.

The finding drawn from these figures is obvious, and is virtually identical to the finding made as a consequence of the April survey:

Four fifths of all new train riders previously traveled to Boston by car.

Only *19.5* per cent of all new riders interviewed previously used the bus to get to Boston, while *80.5* per cent got to Boston by car, *63.6* per cent in their own car, and *16.9* per cent as part of a car pool.

The percentage of new New Haven riders who previously used the bus is substantially higher than the percentage of new B&M riders who were former bus riders: *25.3* per cent of New Haven users were ex-bus riders, compared to only *5.1* per cent of new B&M users.

c. Getting to the Station

Each passenger was asked, "How did you get to the station today to catch this train?"

Method	Apr. 63 B&M only	Nov. 63 All riders	Nov. 63 B&M only	Nov. 63 NH only
Used own car, parked at station	42.3	41.0	40.1	41.8
Walked	28.1	27.7	27.6	27.8
Took bus	2.5	1.8	2.5	1.2
Took taxi	4.3	2.2	2.9	1.7
Driven to station by member of family, dropped off	21.2	25.5	25.0	25.9
Came in a car pool	1.6	1.8	1.9	1.6

The similarities here are striking, both in the comparison of the April and November surveys, and the correlation of the B&M and New Haven respondents.

The only significant difference in overall attitude between November and April appears to be that more train riders were being driven to the station by a member of their family, and fewer were taking a taxi or bus.

Again, more than three riders in five went to the station by automobile and more than one in four walked to the station.

d. Reaching the Eventual Destination

There were some substantial differences between B&M and New Haven riders when they left the train in Boston.

More than four out of five New Haven riders walked to their eventual destination in Boston, while only two out of five B&M riders walked to their eventual destination.

The B&M results in this survey were substantially the same as the April survey, with these differences:
A slightly lower percentage walked to their eventual destination in November than in April.

There was approximately a 50 per cent increase in the number of B&M riders who said they reached their final destination by MTA bus, while the percentage who said they reached their final destination by MTA subway remained the same.

Method	Apr. 63 B&M only	Nov. 63 All riders	Nov. 63 B&M only	Nov. 63 NH only
Walk	45.3	64.5	40.3	83.3
MTA subway	38.8	22.2	38.8	9.2
MTA bus	10.4	9.8	16.3	4.8
Taxi	5.5	3.5	4.6	2.7

An obvious reason why twice as many New Haven riders walked to their eventual destination is the more central location of the South Station, where New Haven trains arrive, compared to the North Station, where B&M trains arrive. In many cases, B&M users have further to go to reach their eventual destinations and thus are more inclined than New Haven riders to use other means of public transportation — MTA subway, MTA bus, or taxi.

B. MTA Buses

1. Goals

The following information of MTA experimental bus service passengers was sought:

The number of new riders attracted since the start of the Mass Transportation Commission experiments.

Whether increased service or lower fares was the more important factor in attracting new riders and what other factors, if any, contributed to increasing MTA bus patronage.

How new users previously traveled to their regular destinations.

What effect, if any, increased use of MTA buses had on other forms of transportation.

What form of public transportation, if any, commuters used to reach their eventual destination after leaving the MTA bus.

2. Scope

Interviews were conducted with riders of three Greater Boston MTA bus routes on which MTC experiments were run. There follows a breakdown of the 714 interviews conducted by route.

Route Number	Name	No. of Interviews
E-3	Sullivan Sq.-Dudley Sq.	265
E-4	Elm Street-Sullivan Sq.	58
E-5	Ashmont-Harvard Sq.	391

All interviews were conducted on the buses themselves, not at bus stops or in bus stations. In most cases, there was one interviewer per bus. On certain rush hour runs, there were two interviewers. Cards were distributed at random and, in many cases, to each passenger on the vehicle. Interviewers were available for assistance in filling out questionnaires.

Interviews were conducted with bus passengers riding in both directions on the three lines.

3. Results

a. Usage

The first two questions on the card compared the rider's frequency of MTA bus use with a period 12 months earlier.

	E-3	E-4	E-5	Total
Using bus more often	32.9	13.9	40.7	35.6
Same number of days	55.9	74.1	50.1	54.2
Using bus less often	11.2	12.0	9.2	10.2

One rider in three was using MTA buses more often.

Within the individual lines, an unusually high 74.1 per cent of the riders on E-4 did not change their riding habits at all after the start of the MTC experiments. But on E-5, two out of five (40.7 per cent) riders were using the bus more often.

b. Increased Patronage

Increased services rather than a lowering of fares (from former combined bus and rapid transit combinations or double bus fares previously required to complete the same journey) was given as the reason for increased bus patronage by almost two to one. Out of every ten persons who answered this question, seven cited one of these two reasons or a combination of both.

Some fairly wide differences are noticeable within the lines themselves. While on E-3 there was almost an equal division between increased service and lowering of costs as reasons for increased patronage, on E-4 and E-5 the increase in services was far ahead as the major factor.

Reason For Using Bus More Often	E-3	E-4	E-5	Total
Increase in services	33.3	52.0	47.1	42.7
Less Costly	32.0	16.0	19.1	23.2
Combination of above	4.4	—	7.4	6.2
Traffic problems	1.5	—	1.5	1.4
Comfort and convenience	13.0	16.0	15.5	14.7
Personal reasons	1.5	—	2.2	1.9
Miscellaneous*	14.3	16.0	7.2	9.9

*Quicker than private car or any other form of public transportation.
MTA bus personnel is much more courteous than MTA Rapid Transit staff.
Generally more "convenient".
Handy because commuter has no car.
Would prefer to drive but another member of family needs car.

c. Previous Means of Transportation

Those passengers who said they were taking MTA buses more often were then asked what form of transportation they had formerly used to get to their regular destinations.

	E-3	E-4	E-5	Total
Own car	18.3	58.0	22.8	22.6
Car pool	1.6	—	11.0	7.6
MTA Rapid Transit	36.6	—	44.6	40.4
Taxi	5.0	14.0	4.2	4.9
Walk	15.1	14.0	7.6	10.2
Train	3.3	—	2.4	2.7
School Bus	5.0	14.0	2.4	3.9
Combination of any above	15.1	—	5.0	7.7

The most significant results were:

Leading the other modes of transportation was MTA Rapid Transit with 40.4 per cent of the new riders indicating they used that method prior to switching to MTA bus. Thus, many "new" riders on the circumferential routes were formerly MTA rapid transit passengers who switched to bus to take advantage of the shorter route offered.

Private car transportation was previously used by 30.2 per cent.

On the E-4 line, 58.0 per cent checked that they had previously used their own cars as regular transportation.

Ten per cent of those interviewed reported that prior to changing to MTA busses, they did not use public transportation or private autos at all but walked.

d. Reaching Eventual Destination After Getting Off The Bus

Method	E-3	E-4	E-5	Total
Walk	54.7	16.4	47.5	47.6
MTA Subway	15.4	74.6	29.1	27.8
MTA Bus	26.8	7.3	21.8	22.4
Taxi	—	—	—	—
Combination of above	2.0	1.7	1.6	1.8
Other (incl. train)	1.1	—	—	.4

Three important findings were established:

47.5 per cent of all riders walked to their eventual destination.

Close to the same number, 50.2 per cent used either another MTA bus or the MTA Subway.

Of the 50.2 per cent, almost half, 22.4 per cent used another MTA bus.

C. MTA Parking Lots

1. Goals

The following information was sought from the users of MTA parking lots:

The number of new MTA parking lot users attracted since the start of the Mass Transportation Commission experiments.

Whether increasing highway congestion or lower parking fees was the major factor in attracting new users and what additional factors, if any, contributed to increasing the number of users.

How new users previously traveled to their destinations.

What effect, if any, increased use of MTA parking lots had on other forms of transportation.

How MTA parking lot users reached their eventual destinations after leaving the MTA Rapid Transit stations.

2. Scope

Interviews were conducted at 15 MTA parking lots.

Questionnaires were distributed to lot users as they left the lots and headed for the Rapid Transit station platforms where the questionnaires were filled out and returned to the interviewers. In this way, any possibility of interviewing a non-parking lot user who might be on the same platform was eliminated.

A total of 616 interviews were made on the Riverside, Revere and Ashmont-Mattapan lines.

This follows the breakdown by line and by station:

Riverside Line	(258 interviews)
Riverside	73
Woodland	62
Waban	28
Eliot	27
Chestnut Hill	22
Brookline Village	46
Revere Line	(262 interviews)
Wonderland	66
Ocean Ave.	28
Beachmont	48
Suffolk Downs	39
Orient Heights	46
Wood Island Park	35
Ashmont-Mattapan Line	(96 interviews)
Butler Street	52
Milton	12
Mattapan	32

3. Results

a. Usage

Respondents were asked about the frequency with which they used MTA parking lots compared with a period 12 months earlier.

	Riverside	Revere	Ashmont Mattapan	Total
Using parking lots more often	21.3	27.9	28.1	25.2
Using parking lots the same number of days	70.2	65.7	69.8	68.2
Using parking lots less often	8.5	6.4	2.1	6.6

Two points stand out from the above results:

The consistency between users of all three lines regarding frequency of use.

One out of four persons was using MTA parking lots more often.

b. Increased Patronage

Two reasons for increase use of the parking lots were suggested on the interview card: highway congestion and lower parking fees. Space was left for additional reasons if the respondents wished to give them.

Congestion and lower parking fees or a combination of both were cited by 79.6 per cent of those responding. Lower parking fees was the leading reason given by users on the Riverside and Revere Lines and highway congestion was cited as the major factor by those on the Ashmont-Mattapan line.

Reasons	Riverside	Revere	Ashmont Mattapan	Total
Highway congestion	26.1	34.4	41.0	32.6
Lower parking fees	30.5	40.6	36.4	36.4
Combination of above	19.6	6.2	4.6	10.6
Personal reasons	8.8	15.6	4.6	11.4
Misc. reasons*	15.0	3.2	13.4	9.0

*Recently acquired a car for first time.
Generally more convenient.
Lack of RR service so must use MTA lots but prefer trains.
Rapid Transit offers better schedules than trains from rider's town.

c. Previous Means of Transportation

The 25.2 per cent drivers who used MTA parking lots more often were asked what method of transportation they previously had used to get to their regular destinations.

Method	Riverside	Revere	Ashmont Mattapan	Total
Own car	67.7	51.0	35.0	53.9
Car pool	8.1	19.1	35.0	18.3
Train	11.0	6.4	—	6.8
Bus	13.2	23.5	30.0	21.0

Almost three out of every four new parking lot users previously used private car transportation to get to their regular destinations.

At lots on the Ashmont-Mattapan line, those who used their own cars and those who were in a car pool were evenly divided. In the two other divisions, former private car users far exceeded those who previously belonged to car pools.

A fairly high 30.0 per cent of the Ashmont Mattapan new users formerly took the bus.

d. Reaching Eventual Destinations

Nine out of ten of all MTA parking lot users walked to their eventual destination after leaving the MTA Rapid Transit station. The percentages were quite similar for the three categories: walk, bus and taxi.

	Riverside	Revere	Ashmont Mattapan	Total
Walk	93.3	92.5	92.0	92.8
Bus	5.2	6.7	8.0	6.2
Taxi	1.5	.8	—	1.0

D. Private Bus Companies

1. Goals

The following information on experimental bus passengers was sought:

The number of new riders on private company busse attracted since the start of the Mass Transportation Com mission experiments.

What form of transportation was previously used by thos who increased their use of private buses.

What effect, if any, increased patronage of private buse had on other forms of transportation.

How private bus users reached their eventual destination after leaving the buses.

2. Scope

Five major private bus lines provided the source for a total of 685 interviews. There follows the breakdown of th 14 sub-divisions within the five major lines.

Barre Bus Company		24
Yellow Coach		
(Pittsfield)	72	
(N. Adams, Adams, Williamstown)	49	121
Fitchburg-Leominster		
(Proj. 1)	41	
(Proj. 4)	10	
(Proj. 5)	37	
(Proj. 6)	18	106
Eastern Mass. St. RR		
Lawrence-Boston	30	
Fall River	229	
North Shore	107	366
Short Line		
Uxbridge-Worcester	14	
Milford-Boston	54	68

Interviews were conducted on the busses. at bus stops and at major bus stations depending upon the circumstances.

3. Results

a. Usage

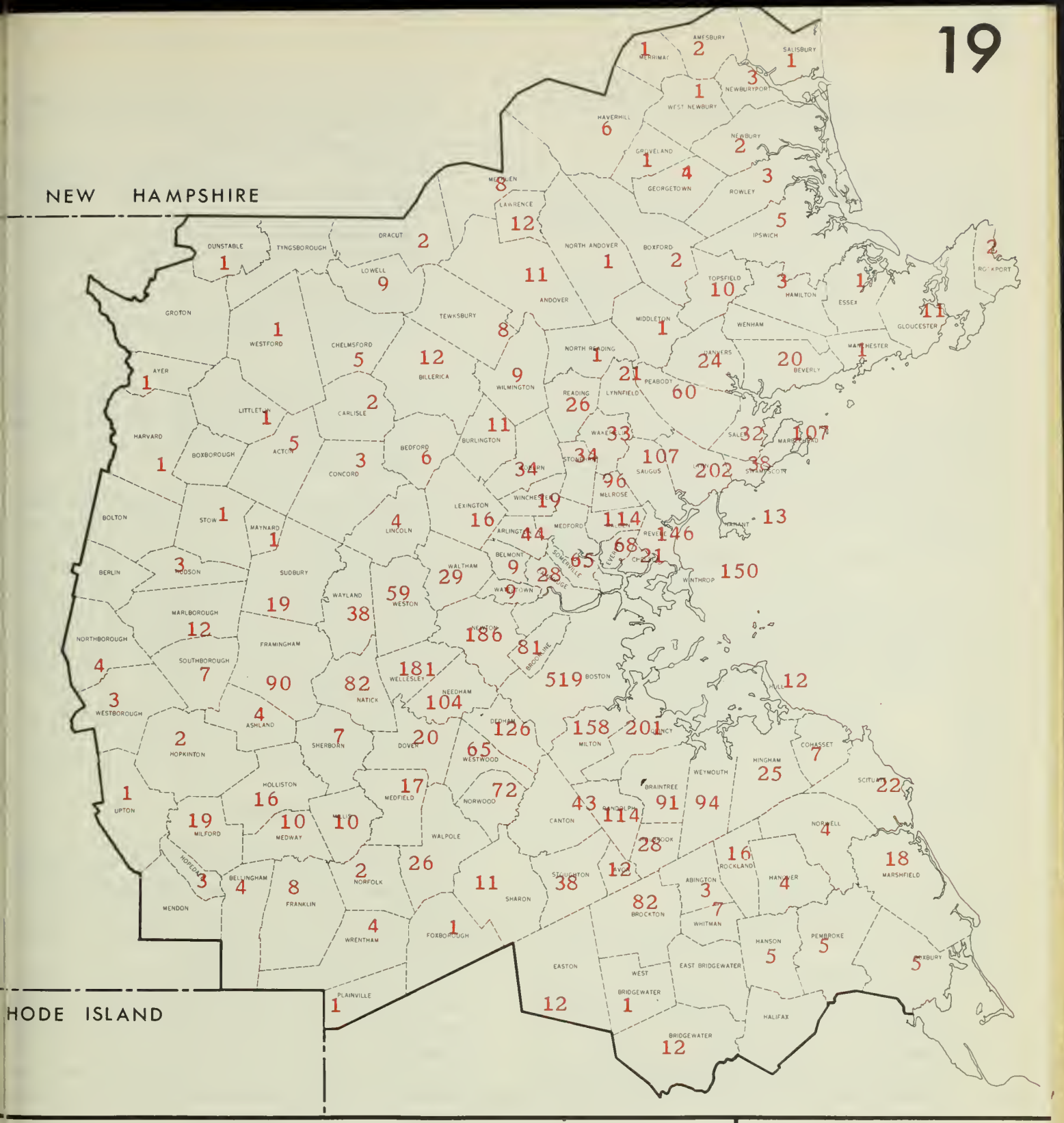
The first objective was to determine the frequency with which riders were using private company buses as compared with 12 months previously.

	Barre	Yel. Coach	Fitch. Leom.	E.M.S. RR	Short Line	Total
Using bus more often	21.0	21.5	22.7	23.2	29.4	23.4
Same number of days	75.0	72.7	68.9	66.4	61.8	67.7
Using bus less often	4.0	5.8	8.4	10.4	8.8	8.9

The most remarkable finding was that although the five lines surveyed service areas spread across the entire Commonwealth of Massachusetts, the results in each category were extremely close.

Other significant findings:

Nearly one out of every four riders was using private buses more often.



PLACE OF RESIDENCE OF MTA PARK-AND-RIDE PATRONS:

SYSTEM TOTAL

SOURCE: MTC SURVEY, 1964

NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

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Two out of three users had not changed their riding habits since the start of the MTC experiments.

b. Previous Means of Transportation

Riders who indicated they were using private buses more often were then asked how they traveled before changing to private bus transportation.

Method	Barre	Yel. Coach	Fitch. Leom.	E.M.S. RR	Short Line	Total
Own car	33.0	64.3	18.1	37.1	67.0	40.0
Car Pool	33.0	28.7	18.1	9.7	11.0	14.0
Taxi	—	7.0	5.1	9.7	—	7.7
Walk	34.0	—	53.6	27.4	11.0	26.7
Train	—	—	5.1	11.3	11.0	8.6
Comb. of above	—	—	—	3.2	—	2.0
Another bus	—	—	—	1.6	—	1.0

40.0 per cent of the new riders previously used their own cars.

14.0 per cent belonged to a car pool.

Over half, 54.0 per cent used some form of private car transportation.

26.7 per cent previously walked to their regular destination.

c. Reaching Eventual Destination

Nearly three out of four riders or 74.4 per cent did not use any public or private transportation after leaving the bus and walked to their eventual destination.

Method	Barre	Yel. Coach	Fitch. Leom.	E.M.S. RR	Short Line	Total
Walk	82.7	82.7	69.5	75.4	59.7	74.4
Taxi	—	1.8	1.0	1.5	1.5	1.4
Another bus	13.0	13.5	23.1	12.0	9.0	13.7
Rapid transit	—	—	—	7.5	23.8	6.5
Car	4.3	1.0	4.2	.6	3.0	1.6
Comb.	—	1.0	2.2	3.0	3.0	2.4

E. Summary and Findings

The following were the findings revealed in this preliminary survey:

1. 22.9 per cent of all train riders interviewed said they are using the train more often than they were a year ago.
   Among MTA bus, MTA parking lot and private company bus users, patronage increased by a quarter to a third.

2. Of the new train riders, 22.3 per cent cited lower fares as the principal reason they used trains more often and 13.8 per cent gave the increase in train services as their prime reason. 6.1 per cent mentioned both.
   Increased services was the leading reason given by MTA bus riders for riding busses more often. MTA parking lot users mentioned lower parking fees more than any other factor, with highway congestion running a close second.

3. When asked how they previously traveled to Boston, 74.7 per cent of the new train users said by their own car or as members of a car pool.
   New MTA bus users: 30.2 per cent previously used their cars or a car pool and 40.4 per cent used MTA Rapid Transit.
   Among the more often MTA parking lot users, a high 72.2 per cent previously used their own cars or belonged to car pools.
   New private bus company users: 54.0 per cent previously used car pools or their own cars and 26.7 per cent walked.

4. Train riders only were asked how they got to the station from their homes to take the train. 41.0 per cent said they drove their own car. 27.7 per cent walked and 25.5 per cent said they were driven by a member of the family.

5. All interviewees were asked how they reached their eventual destinations after leaving their regular mode of transportation.

Among train riders a total of 64.5 per cent walked with a wide difference exhibited between the New Haven users (83.3 per cent) and those on the B&M (40.3 per cent).

MTA bus users . . . 47.6 per cent walked to their eventual destination. 27.8 per cent take the MTA subway and 22.4 per cent take another MTA bus.

Nine out of ten MTA parkling lot users walked to their eventual destination.

Among private bus company users, 74.4 per cent walked.

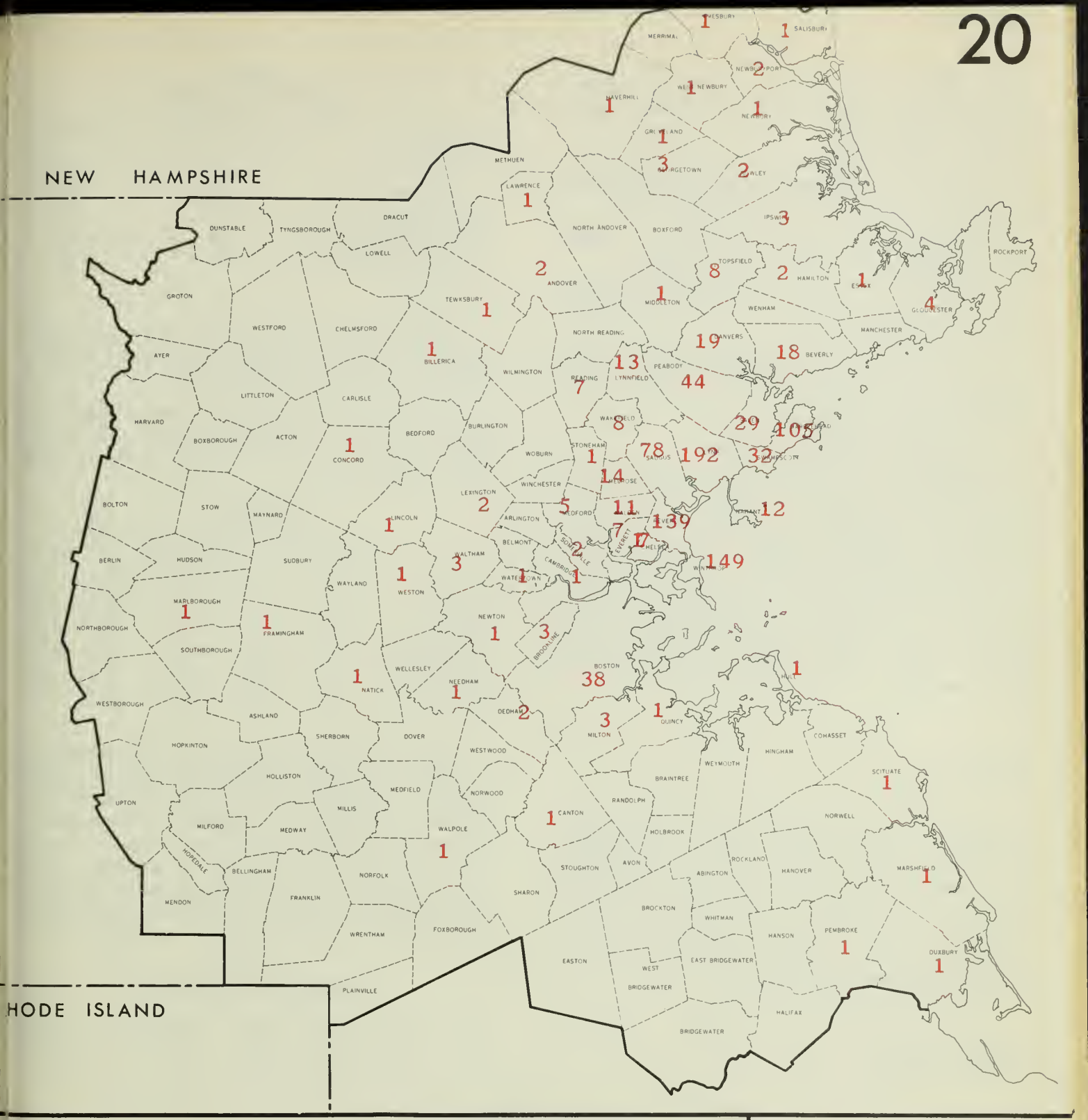
IV. In-Depth Interviews

As the result of a year's experience with passenger surveys, it became apparent that statistically valid in-depth personal interviews of the passengers using the MTC experimental services, and a control group of automobile commuter, would yield valuable data and insights for a thorough evaluation of the Demonstration Project.

The early results of the Demonstration Project had indicated a basic need to apply the analytical tools of modern marketing if the maximum ultilization of available public transportation facilities was to be achieved. The five-fold objective of the in-depth interviews could be summarized as an attempt to develop an elementary analysis of the public transportation individual purchaser in the working framework of the modern marketing techniques.

A. Goals

The material herein presented is in a style more normal to a working paper in an advertising agency rather than a technical transportation study report. The need for this approach was substantiated in the continuing MTC staff analysis of the actual advertising and public relations prac-



PLACE OF RESIDENCE OF MTA PARK-AND-RIDE PATRONS:

EAST BOSTON LINE

SOURCE: MTC SURVEY, 1964

NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

tises and skills of carrier management. A full, more technical presentation of this same material is contained in Supplement Four to this report.

The particular objectives of the home interviews were:

1. To obtain a comprehensive image of the public transportation user and the private automobile use.

2. To determine his regular travel habits and ascertain pertinent details concerning his everyday trip.

3. To establish his reasons for choosing the mode of transportation he regularly uses and discover why he prefers one mode of travel over another.

4. To compare the frequency of use of his chosen mode of travel with a period of twelve months prior to the survey and determine the reasons for:

a. Any change in frequency of patronage

b. Any change in mode of travel used

5. To determine his attitudes and his recommendations and criticisms concerning the schedules, fare structures, operations, overall policies, management and personnel of certain public transportation facilities in Massachusetts, and, in so doing, establish a correlation of these points-of-view between users and non-users of public transportation. This survey was not intended to be a detailed market survey designed to predict future passenger potential for mass transit but rather a survey which would help define the present markets.

B. Scope

As a part of the Second Napolitan Survey, the names and addresses of possible in-depth respondents were obtained. From this list a further refined sample was constructed so that a minimum 10% sample of the users of each MTC demonstration experimental service could be interviewed. The per cent of sample for private automobile users is unknown, but the total number interviewed is large enough so that the data can be reliably compared with that obtained from the public transportation samples.

A total of 1379 in-depth interviews were conducted as follows: (Table 72).

TABLE 72

NUMBER OF INTERVIEWS

Transpartation	Number of Interviews Conducted	Percentoge of Total Interviews
Troin		
B&M	393	28.5
New Haven	320	23.2
MTA Bus Riders	91	6.6
MTA Porking Lot Users	166	12.0
Privote Bus Riders	157	11.4
Privote Automobile Users	252	18.3

C. Results

Automobile users tended to have higher incomes than bus users, and rail passengers' incomes tended to fall between the two, as shown in Table 73.

Table 74 reveals the low auto ownership of MTA and private bus riders as compared to those who use the train. This is indicative that *some* of the patrons of mass transit are a captive market.

TABLE 74

AUTO OWNERSHIP BY MODE SURVEYED

Survey	Number of Cars Owned 0	1	2	3	4
Train	5.2%	64.6%	26.1%	3.2%	0.8%
Auto	1.5	53.0	40.2	5.0	0
MTA Parking Lot	2.9	55.3	37.1	3.5	1.2
MTA Bus	37.4	51.6	11.0	0	0
Private Bus[1]	20.0	60.0	14.3	5.7	0

[1]Work trips only.

Table 75 reveals the attitude of public transportation passengers towards the convenience of the actual schedules of public transportation service. The rail passengers had a substantially higher level of satisfaction with schedule convenience. Rail passengers have been "trained" to consult and abide by printed timetables. In answering another question over half of all those interviewed indicated that they would make more frequent use of the MTA if the MTA were to similarly publish and abide by timetables.

TABLE 75

CONVENIENCE OF SCHEDULES

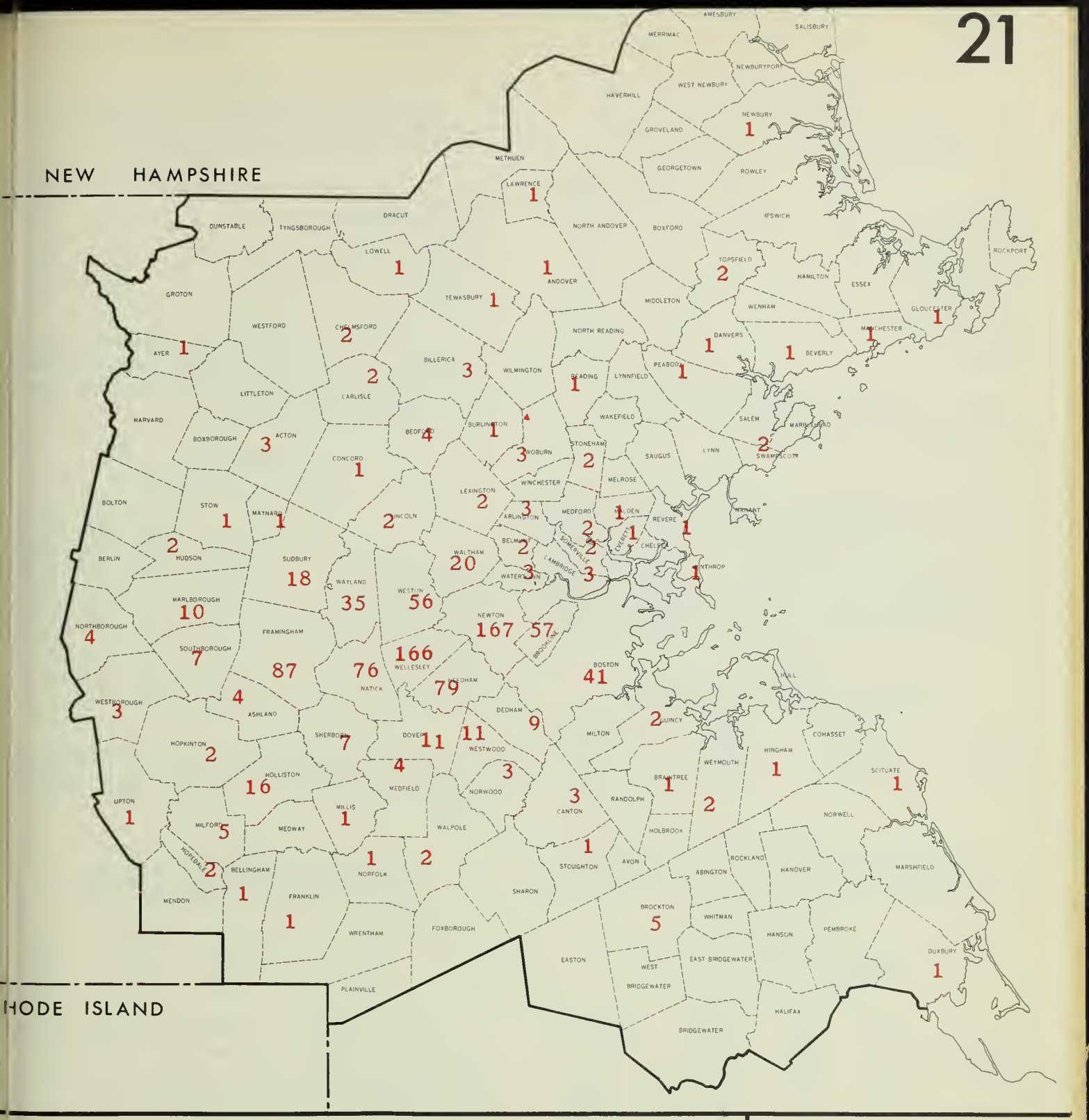
Answer	B&M	NH	MTA Bus	MTA Parking	Private Bus
Yes	90.6%	88.1%	67.8%	93.9%	66.7%
No	9.4	11.9	32.2	6.1	33.3

TABLE 73

INCOME BY MODE SURVEYED

Survey	Under $2,000	$2,000 –4,000	$4,000 –6,000	$6,000 –8,000	$8,000 –10,000	$10,000 –12,500	$12,500 –15,000	$15,000 –20,000	$20,000 –30,000	Over $30,000
Train	1.8%	8.3%	19.1%	20.6%	17.7%	12.6%	8.8%	5.9%	3.3%	1.8%
Auto	0.4	3.9	11.6	18.1	18.5	19.8	11.6	6.5	7.8	1.7
MTA Pkg. Lot	1.3	9.4	20.1	19.5	20.8	10.0	5.4	6.7	2.7	4.0
MTA Bus	15.9	39.0	20.7	11.0	7.3	4.9	0	1.2	0	0
Privote Bus[1]	9.1	15.2	27.3	21.2	12.1	6.0	3.0	0	3.0	3.0

[1]Work trips only.



PLACE OF RESIDENCE OF MTA PARK-AND-RIDE PATRONS:

RIVERSIDE LINE

SOURCE: MTC SURVEY, 1964

NORTH

1 = 2560 ACRES

SQUARE MILES

0 5 10 MILES

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TABLE 76

ADVANTAGES OF TRAINS, MTA BUS, MTA PARKING

	B&M	NH	MTA Bus	MTA Pkg.	Priv. Bus
Eliminates Troffic Problems	21.0%	18.7%	14.9%	34.2%	17.0%
Eliminates Parking Problems	8.9	7.2	16.4	16.4	10.2
More Comfortable & Convenient	45.7	50.5	25.4	18.4	15.8
Faster than other Transportation	7.9	14.8	1.5	10.1	2.4
Less Expensive	14.4	8.5	7.5	16.4	5.3
Need not own car or leove at home	- -	- -	31.3	.6	31.5
Other	2.1	.3	3.0	1.3	15.8

Table 76 indicates that the prime factor in the use of public transportation was comfort and convenience rather than economy.

Table 77 indicates the wide range of passenger attitudes towards the services they use. Answers to other questions indicate that the higher rating of the B&M over the New Haven was due to the better equipment, more frequent service and generally lower fares found on the B&M. Answers to other questions posed to MTA bus passengers indicate that the low rating was because of lack of comfort and speed.

TABLE 77

OPINION OF TRAIN AND MTA BUS SERVICE

Rating	B&M	NH	MTA Bus
Excellent	53.7%	27.4%	11.2%
Gaad	40.0	55.4	33.7
Fair	4.6	15.6	30.3
Poor	1.7	1.6	24.8

The respondents were asked how they would travel if their train or bus service were eliminated. A very high percentage in each case indicated they would drive.

TABLE 78

"IF TRAINS OR BUSES WERE ELIMINATED, HOW WOULD YOU TRAVEL?"

New Mode	B&M	NH	MTA Bus	Private Bus
Bus	21.7%	22.1%	1.3%	
Drive own Car	44.3	35.2	26.0	22.0
Car Pool	26.4	20.4	27.3	36.6
Other	7.6	22.3	27.3	22.0
Taxi	- - -	- - -	11.7	4.8
Combination	- - -	- - -	1.2	- - -
Train	- - -	- - -	- - -	14.6

Those who now use mass transit evidently would not drive to Boston if downtown parking were inexpensive and easily available. The only departure from this pattern are the users of MTA parking lots. This reinforces the findings of the MTA parking lot experiments that an attractively priced parking lot policy is necessary to gain the maximum MTA riders potentially available.

TABLE 79

INCREASED AND LESS EXPENSIVE PARKING MADE AVAILABLE AT DOWNTOWN BOSTON DESTINATION.

	B&M	NH	MTA Bus	MTA Pkg.	Private Bus
Continue to use Mass Transit os often os now	90.9%	96.7%	90.2%	77.4%	90.9%
Drive Car more often than now	5.8	2.0	2.0	10.4	3.3
Drive Car most of the time	3.3	1.3	7.8	12.2	6.7

Respondents who indicated that they had switched from automobile to public transportation within the previous five years were asked the reason. Improved service was clearly the chief factor, shown in Table 80.

TABLE 80

"WHY DID YOU STOP DRIVING?"

	B&M	NH	MTA Bus	MTA Pkg.	Private Bus
Fotigue from driving	- - -	2.7%	8.3%	1.8%	20.0%
Traffic congestion	6.4%	8.1	- - -	20.0	20.0
Porking unavaidable	- - -	1.4	- - -	3.6	- - -
Porking toa expensive	1.0	- - -	- - -	3.6	- - -
Cost af automobile use	1.9	1.4	- - -	3.6	- - -
Moved from another location to present address	18.2	31.0	16.7	20.0	- - -
Other incl. improved service	47.8	36.5	66.7	23.7	60.0
Combinotian	24.7	18.9	8.3	23.7	- - -

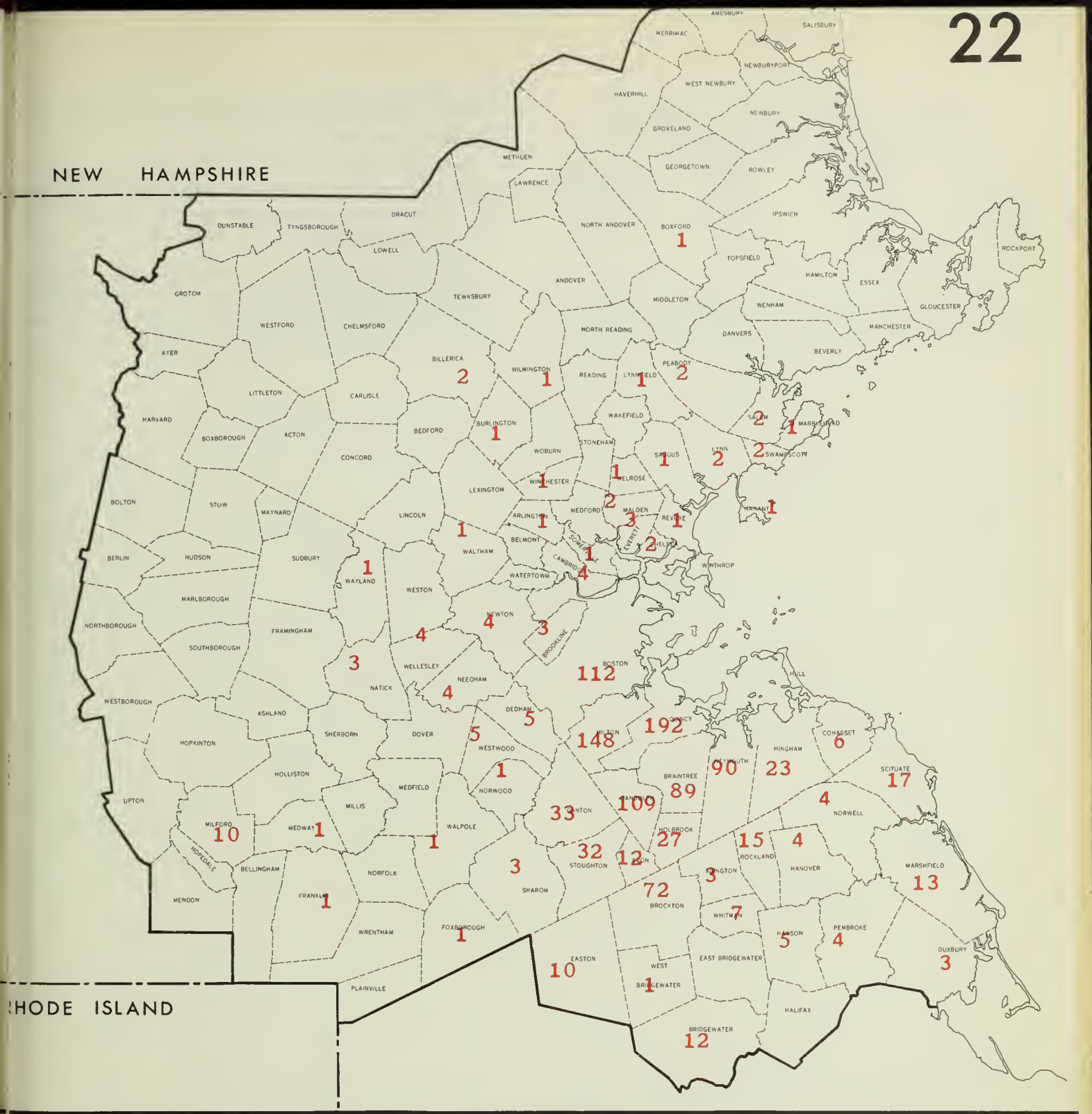
Table 81 indicated that a percentage of riders would have to change jobs if the present mass transit service were not available.

TABLE 81

IS PUBLIC TRANSPORTATION A FACTOR FOR RESPONDENTS STAYING ON THEIR PRESENT JOB?

	B&M	NH	MTA Bus	MTA Porking	Privote Bus
YES	39.1	27.0	50.6	14.0	51.2
NO	60.0	73.0	49.4	96.0	48.8

The in-depth interview of commuters who drive daily to Boston revealed that 50 per cent had used train service within the past five years, 3 per cent had used MTA Bus, 1 per cent private bus, 15 per cent rapid transit, 7 per cent car pool, and 24 per cent a more than one of the modes. The prime reason given for shifting to automobile was personal convenience and comfort. Table 82 indicates how automobile users who had used public transportation within the last five years rated their experience. Those who had been satisfied with their mass transit experience switched to automobile primarily because of a need for their car at work or a shift of employment or residential location. The bus rating was poor, primarily because the respondents indicated that it was an uncomfortable and slow mode of transportation.



PLACE OF RESIDENCE OF MTA PARK-AND-RIDE PATRONS:

MATTAPAN LINE

SOURCE: MTC SURVEY, 1964

NORTH

1 2560 ACRES
SQUARE MILES

0 5 10 MILES

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TABLE 82

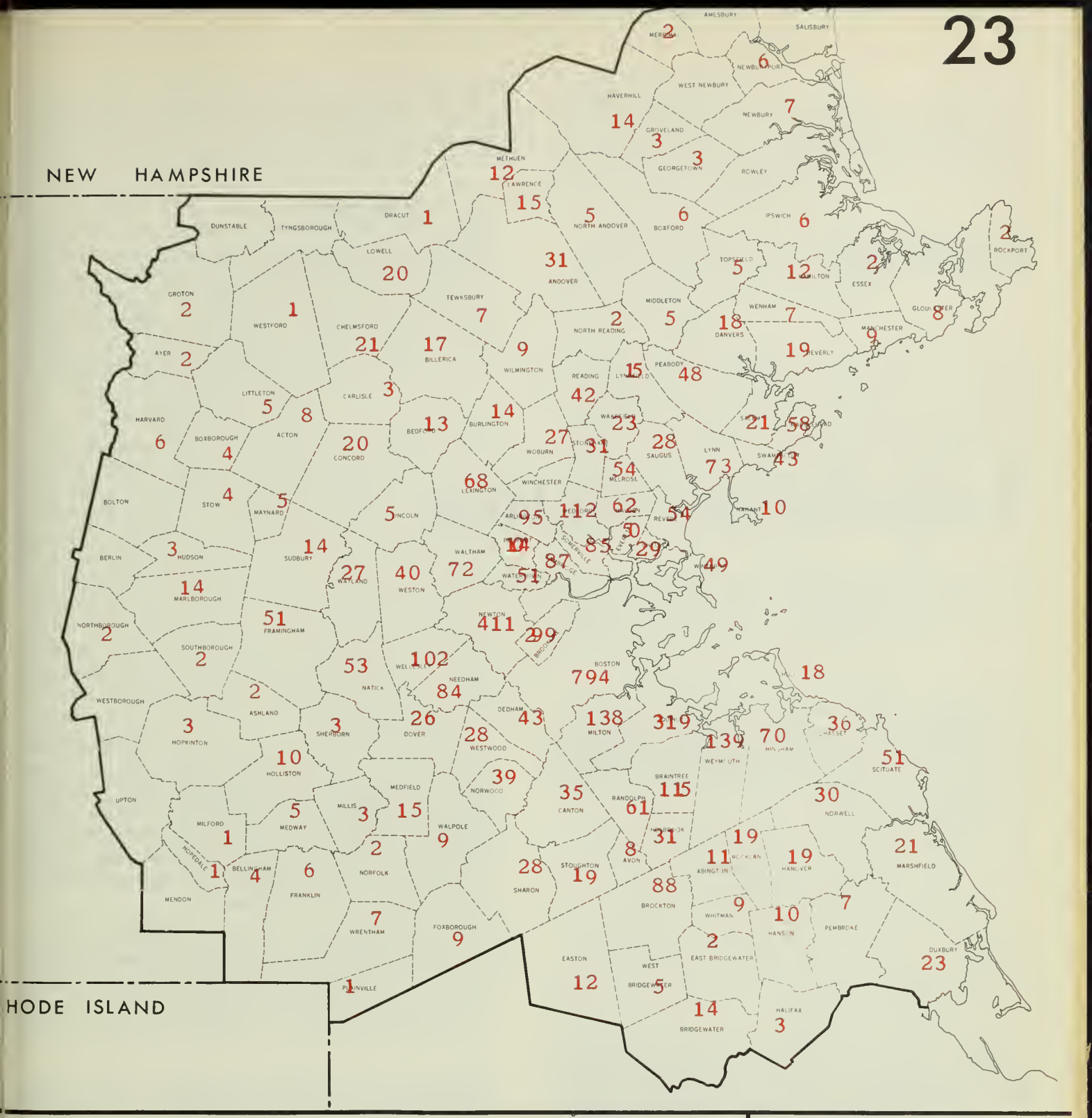
AUTOMOBILE USERS' RATING OF PREVIOUS PUBLIC TRANSPORTATION EXPERIENCE

	Railroad	Bus	MTA Parking
Excellent	4.5%	4.5%	8.9%
Good	26.9	10.6	24.8
Fair	21.2	16.7	22.8
Poor	2.5	66.7	43.5

When automobile users were asked what would cause them to consider a shift to mass transit, 41 per cent said increased service, while only 20 per cent said economy. This reinforces the finding that frequency of service is more important than fares.

Automobile users were posed the hypothetical question that, given equal service and fares, which would they choose, bus or rail service. Seventy-eight per cent replied rail, 13 per cent bus and 9 per cent were undecided.

The interviews also revealed that 66 per cent of the auto users paid parking in Boston, 22 per cent paid tolls each day and over 50 per cent of the drivers carried a passenger and of these passengers, 54 per cent paid for their ride.



PLACE OF RESIDENCE OF AUTO COMMUTERS USING 12 BOSTON OFF-STREET PARKING GARAGES

SOURCE: MTC SURVEY, 1964

NORTH

2560 ACRES
1 SQUARE MILES

0 5 10 MILES

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

Chapter Eight

Legislative Action

On June 18, 1964 Governor Endicott Peabody signed into law a bill creating a new comprehensive mass transportation agency for the Commonwealth of Massachusetts. In so doing, significant improvements in public transportation have been implemented. These are:

Geographical, financial and administrative expansion of the rapid transit system, rail commuter service and bus service in the Boston Metroplitan Area;

Authorization for public transportation authorities or agencies in other Massachusetts urban or metropolitan areas.

Tax relief and reimbursement for school fares for all Massachusetts' bus companies.

Other aspects of the bill include provisions for further expanding the Boston region's transit district, requirements for coordinated planning of public transportation and highways facilities, a system of making fare and service changes, relief from the existing debt and a broad based representation on the new board of trustees. Revenue support for the legislation will be provided by a two cent increase in the state cigarette tax. The bill is the culmination of several years of concern over public transportation, particularly in the Boston region.

(See Supplement One to this report, particularly the first section.)

I. Background

This program of the Governor and the Massachusetts Legislature is a result of the $5.4 million Mass Transportation Demonstration Project made possible by a $3.6 million Mass Transportation Demonstration grant from the Office of Transportation of the Housing and Home Finance Agency and by a $1.8 million appropriation of the legislature of the Commonwealth of Massachusetts and administered by the Mass Transportation Commission.

One of the principle objectives of the Mass Transportation Commission's Demonstrative Project was to determine if the declining trend in public transportation could be reversed. The various experiments showed generally that if the public transportation system were improved, more people would use it.

In the Mass Transportation Commission's Fifth Progress Report (November, 1963), the staff of the MTC suggested ways of dealing with public transportation problems of the state so that the decision-makers of the Commonwealth of Massachusetts could make long range plans.

After a careful analysis of the results of the demonstration experiments, it was evident that a comprehensive solution was necessary. Consequently, the staff recommended in that report that the MTA district of 14 cities and towns be enlarged, that private bus company and MTA operations be coordinated, that bus companies be relieved from the pay-

ment of fuel and excise tax and be reimbursed for school fares, that the commuter railroads serving Boston receive payments for their services and that a single agency manage mass transportation operations within the region.

On April 21, 1964, Governor Peabody appeared before the Massachusetts Legislature requesting that they act upon the mass transit program he presented. The public strongly supported a mass transit program prior to and after his message. After much diligent work by the Joint Ways and Means Committee, the House of Representatives and the Senate gave final approval to the bill on June 17, and the Governor signed the bill into law on June 18, 1964.

II. The Massachusetts Bay Transportation Authority

The Massachusetts Bay Transportation Authority (MBTA) was created by the bill to assume the functions of the now abolished Metropolitan Transit Authority (MTA) which had operated since 1947 in 14 Metropolitan Boston cities and towns. The MBTA now encompasses these 14 communities plus an additional 64 cities and towns, as shown on the accompanying map. The authority is empowered to construct various rapid transit lines, to coordinate the services of the various private bus companies within its district, to make contracts for the services of, or purchase of, these bus companies, to make contracts with railroads of the region for commuter services and to participate in the overall, comprehensive transportation planning for the Boston Metropolitan Region.

The MBTA statute provides that the authority may purchase equipment and facilities and lease them to private bus companies operating totally or partially within the MBTA district. This will give many bus operators a chance to rehabilitate their fleets with modern efficient equipment.

Also, the MBTA may aid individual carriers through contracts in which the bus company provides service over a given route or routes at a stipulated price. With this provision, it will be possible to satisfy public necessity and convenience and permit the private operator to continue operating in unprofitable areas.

The MBTA is also empowered to purchase all or a portion of any private company at its fair market value when it deems this to be the most desirable alternative for the maintenance of essential services or the establishment of new services.

To provide for the types of expenditures involved in helping the private bus industry, fifteen million dollars worth of bonds may be issued by the MBTA.

The MBTA legislation does not specifically require the construction of any new rapid transit lines, but it does provide $55 million for constructing and equipping new lines at the discretion of the authority with the approval of the advisory board. Rapid transit extensions to Reading, to to Braintree, to West Cambridge, to Dedham and to Needham are under consideration.

To further strengthen the ability of the MBTA to expand to meet the needs of the public, the authority may receive federal funds provided by the $375 million Mass Transportation Legislation enacted in July, 1964.

For the railroads, the act provides them with an opportunity to sell their commuter services to the state at a negotiated monthly price. To finance the purchase of this service, the MBTA can sell $10 million of bonds and use these funds over a maximum of three years. One half of the debt service of these bonds comes from the state, the other half from the MBTA district. It is anticipated that within three years, several rapid transit extensions will have been constructed over rail rights of way.

At that time MBTA can decide what rail lines it wishes to retain, and assess any operating deficit incurred 75% upon all the communities in the MBTA district and 25% upon those communities which receive the service.

The act allows the new MBTA district to expand by providing that the majority of the voters in a community contiguous to the MTA district may choose to join the district. The legislation also provides that any community may vote not to receive MBTA service provided that such a service discontinuance does not affect any other community not so voting. In addition, any of the other SMSA's in Massachusetts may vote to create an authority similar to the MBTA so as to take advantage of state and federal aid to urban transportation.

The new transit authority will be managed by five directors appointed by the Governor, two of whom are approved by the Governor's Council, one by the MBTA advisory board, one by the 14 cities and towns of the old MTA district and one by the new 64 cities and towns. One of the directors is appointed Chairman by the Governor. No more than three of the five directors can be from the same political party. Each director will hold office for five years in such a manner that a new director is appointed each year.

Each city or town is represented on an advisory board and has voting rights on the board in proportion to the relationship between the tax assessments in each community and the total assessments of the MBTA district. The responsibility of the advisory board is to approve annual budgets, approve capital expenditures, approve substantial service or fare changes, and provides general guidance for the directors based upon the desires of each respective community.

The revenue bond issue authorized by the MBTA legislation, is supported by a two cents a pack increase in the cigarette tax. This revenue financing is further backed by the taxing power of the cities and towns and of the Commonwealth. By placing the debt service on a state-wide base, the cigarette tax the bill recognizes that the economic viability of the Commonwealth depends greatly upon a healthy Boston.

Below is a summary of the bond issue allocation set up in the legislation:

	(Millions)
Rapid Transit Extensions	$ 55.0
Purchase of MTA Facilities (debt)	145.0
Railroad Service	10.0
Private Bus Company Aid	15.0
Total	$225.0

Any deficit caused by the operation of any bus route will be borne 50% by the residents of the community which it serves and 50% by the whole MBTA district. Any deficit from rapid transit operations will be first met by an increase in fare on the line and if this is not feasible then by assessing 75% of cost on the MBTA district and 25% on the communities served by the line in proportion to the number of riders from each community.

One of the largest burdens upon the MTA was the debt it assumed from its predecessor, the Boston Elevated Street Railway. The act provides $145 million in bonds to purchase the present debt, thereby spreading the capital cost of the Boston subway system over the entire state rather than limiting it to the MTA or MBTA district.

III. Massachusetts Public Transportation Action

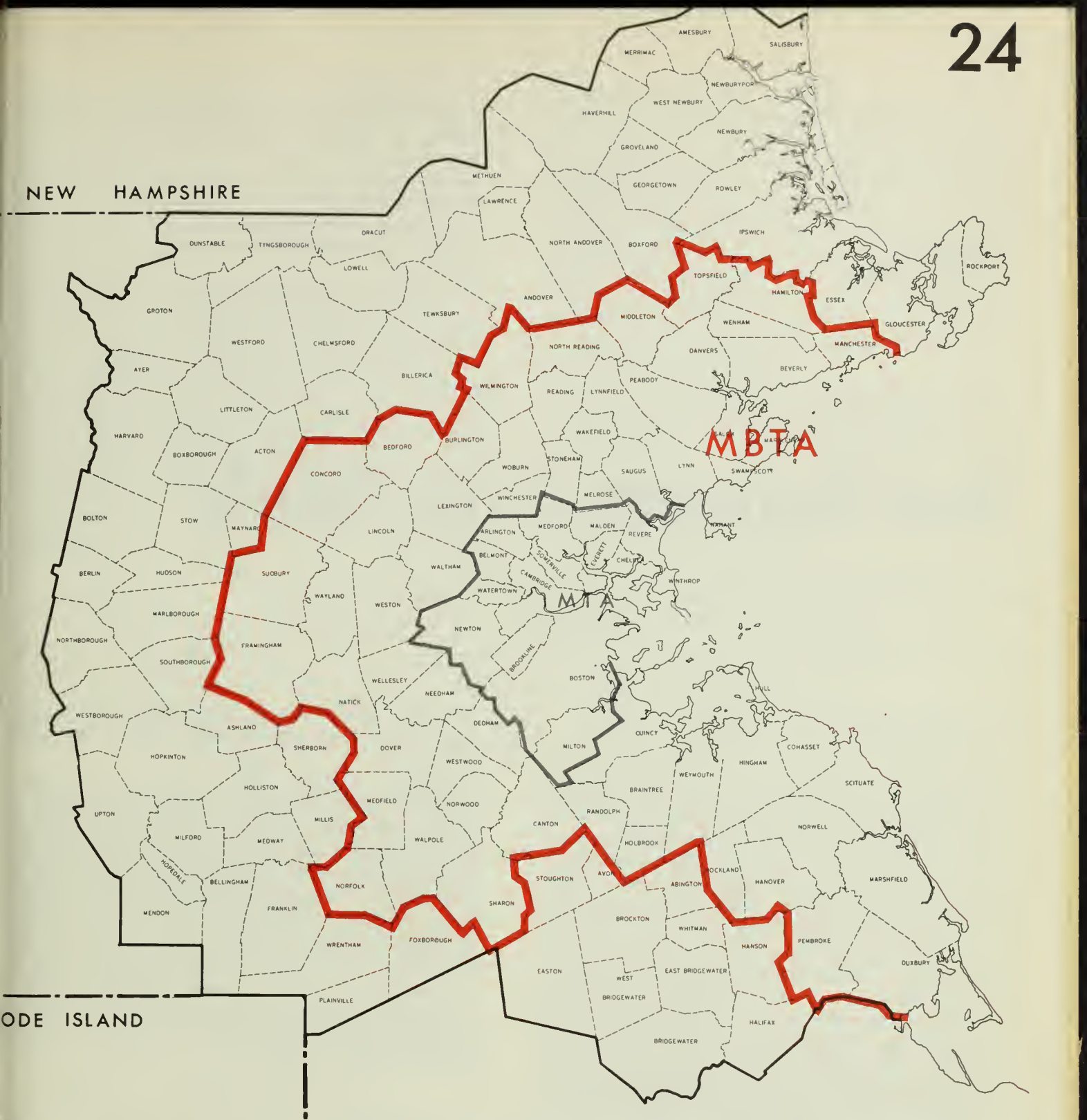
In addition to the specific action in the Boston Metropolitan Region, several provisions, in addition to those mentioned above, of the bill have statewide applicability.

For the first time, the responsibility for statewide transportation planning will be centralized in one agency. The Department of Public Works will establish a bureau of transportation planning and development for coordinated highway and mass transit planning.

Because of the mass transit legislation, the private bus companies of Massachusetts once again have the prospect of receiving a reasonable return on their investment. The legislation makes all regular route carriers exempt from paying excise taxes on equipment (a potential saving of $225,000 per year) and exempt from all state fuel taxes to the extent of their total bus miles operated divided by five (a potential saving of $400,000 per year). Moreover, the cities and towns will be reimbursed for school children's bus fares (only children who live 1.5 miles from school are eligible) so that they may, in turn, reimburse the bus company which is required by law to charge school pupils one half the regular adult fare. While previous to the MBTA legislation, communities could reimburse bus companies for carrying school pupils, many were not financially capable of doing so. State aid will now make proper reimbursement possible.

The purpose and final legislative effect of a demonstration program as carried out in Massachusetts is perhaps best expressed by John C. Kohl, Assistant Administrator of the Housing and Home Finance Agency in charge of its Office of Transportation in his article "The Federal Urban Transportation Demonstration Program" in the July 1964 *Traffic Quarterly*, published by the ENO Foundation:

> The demonstration has long been a useful device for achieving an effective linkage between research efforts and their practical application. The demonstration project is being increasingly recognized as a significant element in the research world when it is a professionally organized activity carried on under well-defined field conditions for purposes of illustrating, interpreting, testing, or validating specific technical developments and their operational consequences.



MBTA DISTRICT

NORTH

1 2560 ACRES
SQUARE MILES

0 5 10 MILES

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

Appendix A

Bus Industry Cost Study

Purpose of a Cost Study

Introduction

This study is a statistical analysis of the cost structure of Massachusetts bus companies. Fundamentally, it is an attempt to determine how costs will vary as the factors which influence them vary. The statistical analysis is intended to serve as a substitute for an experimental procedure which would proceed by varying the influencing factors in a controlled fashion and noting the results.

It is important to be able to predict accurately how costs will change when conditions change, but it is necessary also to obtain information concerning the relationships between the causal factors and costs. In this section, the nature of the possible relationships between operating levels and costs will be described and the significance of these relationships to management policy will be outlined. After the discussion, the nature of statistical analysis and its relationship to the experimental approach will be described.

Relationships Between Costs and Operating Levels

Fixed and Variable Costs

Before describing this relationship, it should be noted that operating levels and costs are not the sole elements of management decisions. Equally important is the relationship between operating levels and revenue. It is a truism that decisions by management with regard to whether to operate at a given level are made by comparing expected costs with anticipated revenues when a specific price is placed upon the product.

While it is necessary to place a price upon any specific portion of goods or services produced, it is tempting to generalize the above truism into the principle that there must be a cost for each such specific portion. If this were so, the major decisions by management could be analyzed into a set of smaller decisions comparing costs and revenues for smaller blocks of service. There are conditions in which such costing can be done, but this is not always so and an adequate cost analysis would show the extent to which management decisions are complicated by absence of simple analyzable conditions.

The simple situation in which a cost can be attributed to each specific portion of production can be represented as in Figure 1 below.

Figure 1

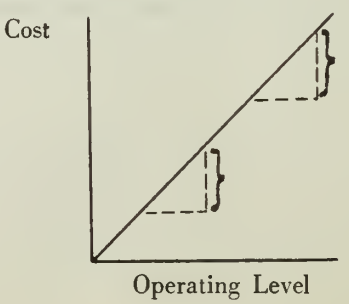
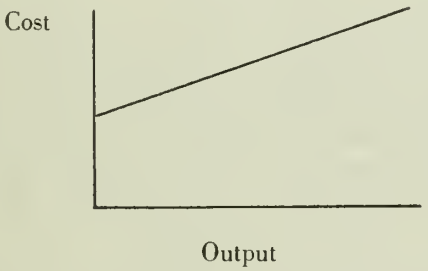


Figure 1 might be thought of as a graph showing the relationship between gasoline cost and bus miles. If the bus is not operated, there is no cost. In this graph, the gasoline cost of a bus mile is everywhere the same. The first mile costs the same as the fiftieth. When the cost of a unit of production is always the same, the graph is a straight line (linear) and the cost is zero when the operating level is zero. This is illustrated in the graph where the two braces are equal for equal changes in output. The ratio of the cost change to the output change is called the incremental or marginal cost. For a linear cost relationship, the marginal cost is constant or everywhere the same. The revenue change that is produced by the output change is called the marginal revenue. When costs are related to production (or output) in this fashion, the decision to operate at a higher level can be made solely on the principle of whether the difference in revenue obtained from the portion of increased production covers the cost of the increase, i.e., whether marginal revenue equals or exceeds marginal cost[1].

A slightly more complicated situation is portrayed by Figure 2.

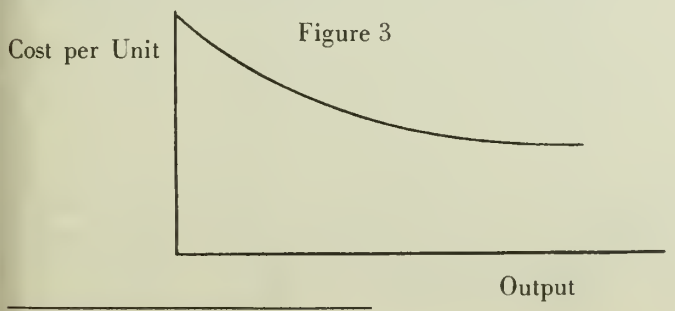
Figure 2



In this case, there is a cost associated with merely getting into the business. Such a situation prevails, for example, for railroad and machine tool companies where a large fixed investment in plant and equipment is necessary before production can begin. The relationship portrayed is again linear. If only a small amount were produced, a relatively large total cost would result. From any point in production thereafter, however, the same amount of additional production will have the same additional cost.

The cost relationship portrayed in Figure 2 is perhaps more familiar in a slightly different form. Quite often companies portray these costs on a unit basis (say per mile). In this case, the linear cost relationship with an initial fixed cost would appear as in Figure 3.

Figure 3



[1]This will be called marginal pricing.

Figure 3 is derived from Figure 2 by dividing each cost level by its associated output level. The cost-per-unit manner of picturing the relationship between output and cost has the psychological advantage of showing costs going down rather than up. Both, however, are pictures of the same situation. Figure 3 does show, however, that if a company were to price a unit of production so that the cost of producing specifically that unit were covered, the amount to be charged would depend upon when the unit was produced. In this case, it is highly likely that no one would be willing to purchase the first unit and either nothing would be produced or the company would retain it in inventory and never recover the cost of its production.

In order to avoid the problem of pricing the first unit, one might consider a pricing policy wherein all units are priced so that each unit sold recovered at least the average unit cost of production. This policy will be called the average pricing policy. For the cost relationship shown earlier in Figure 1, the average pricing policy and the marginal pricing policy come to the same thing because the marginal cost is the same as the average cost.

For costs represented by the second graph, however, the two policies produce different results. The two results may be summarized as follows: If all produced units are sold.

1. Average pricing will recover the total cost of production but opportunities to sell a produced unit for more than it cost to produce may be lost.
2. Marginal pricing will never lose an opportunity to sell a unit for more than that unit's cost of production, but the total cost of production may never be recovered.

On the face of it, it would appear that the average pricing scheme is the more conservative and considerations of prudence would suggest its use. The assumption that all produced units are sold is a strong one, however, and one must consider the relationship between price and demand. As long as there is production of units not yet purchased, no pricing policy will carry a guarantee that all costs will be covered; much less, that a reasonable profit will be returned.

The discussion up to this point may be summarized by saying that costs cannot always be uniquely identified causally with specific portions of production. The identification fails when fixed costs exist. All that can be said about fixed costs is that their percentage contributions to total costs become less as production increases and that, if a company is to remain in business, it must choose a pricing policy that will recover them.

Because the percentage contribution of fixed costs to total costs becomes less as production increases, a firm that has such a cost structure has a different incentive than does a firm with no fixed costs. To the extent that demand exists for production that is priced at less than the average cost but greater than the variable or marginal cost, the firm has an incentive toward extra production. The profit derived from the extra production can then be applied to the total cost of

production (or profit) or, alternatively, may allow a general price reduction and thus stimulate demand wherein a yet greater net revenue may result.

When a company contemplates expanding its production of services or goods, it is often claimed that a certain portion of the production cost (in this case the fixed cost) is free because it was already incurred for previous production. Normally, this claim is never made if the new service can be sold at a price that will more than compensate for the new resulting average or fully distributed cost. This claim serves to point up one fact: that, if the company can sell the increased amount at more than the variable cost of the extra amount produced, its revenue will be increased.

The above claim is not so much a statement of fact, however, as a decision that costs are to be allocated among the produced units in a particular way. In this case, it is a decision not to allocate the fixed cost to the extra amount produced. Another decision could be reached, however, that all costs are to be fully allocated on an equal basis among all the units of production regardless of the total amount produced. If this were done, the claim could be made that the extra production was actually sold at a loss, but that the revenue obtained from the previous production was, by virtue of the extra production, more than correspondingly augmented. Admittedly, this is a paradoxical way of describing the situation where a marginal pricing policy is used. It is, however, equally as accurate as the previous description and merely reflects a different accounting decision. The fact remains that, if a firm has fixed costs, it will always be in its best interest to produce when demand exists for the production at a price that at least defrays the marginal cost. The use of marginal pricing policy does not imply that the full costs of production do not have to be recovered through sales. No pricing policy can guarantee such a full recovery, but all policies must aim at it.

The above remarks are intended to show that, when a particular segment of a firm's production is to be analyzed economically, if fixed costs exist, then these costs will have to remain unallocated. Instead of asking how these costs should be allocated, the relevant consideration will be the amount of return required to induce a firm to provide a given service.

Common and Joint Costs

The existence of fixed costs is not the only situation in which a problem of cost allocation arises. Such a problem also arises when a firm incurs joint costs. Joint costs arise when the production of a given amount of one kind of service necessarily results in the production of a specific amount of the requirements for another kind of service.

Joint costs are to be distinguished from common costs. Common costs arise when outlays are made for two or more classes of service but the proportion of the outlay for any one given service is not fixed as in the joint cost case but may be varied depending upon management decision. Figure 4 shows the joint production cost relationship.

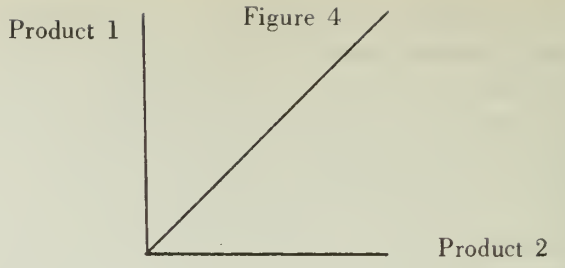


Figure 4

In Figure 4 the joint relationship is linear. In this case the amount of service of the second class per unit of first class is always the same.

The costing of a service that has some of its components jointly produced in conjunction with one or more other services offers the same difficulties as does costing when fixed costs are present. As in the fixed cost case, a certain portion of the production cost associated with expanding service has already been incurred for previous production. Once again the claim is often made that in this case that portion of the production is free. The same evaluation of such a claim can be made as in the fixed cost case; that is, the claim is really a decision to allocate production costs in a certain way and other decisions can be made.

The relationship between two joint costs is similar to that between fixed and variable costs. That is, the portion of the total which is to be allocated for pricing purposes for one of the products must be decided on other than cost facts. Usually it is based on demand. For example, a bus company with a strong demand for its rush hour service may allocate costs heavily to that service, leaving the off-peak service (jointly produced) relatively free of cost.

A cost study can be characterized as a study that depicts the cost structure of a firm. It describes where fixed and joint costs occur and estimates the amount of fixed costs. It will also give estimates of the marginal costs: of the costs that are variable, it will attempt to find the factors that cause the variance and give a numerical estimate of how changes in the factors will yield changes in cost.

When a particular segment of service is costed, the most that can be expected (if it is a cost analysis solely) is the following:

1. The listing and separation of all marginal costs of production into two classes, those which are the result of joint production and those which are not. The numerical values assigned to the jointly produced components will be the full marginal cost of the joint production.
2. The listing and estimates of all the fixed costs that the firm incurs for its entire production.

An analysis of costs makes no judgments as to how the fixed and joint marginal costs of production are to be allocated to any given portion of a service. Such a judgment reflects a decision concerning the return that will be required from the segment of service. This decision is one that cannot be made in isolation from the total system pricing policy

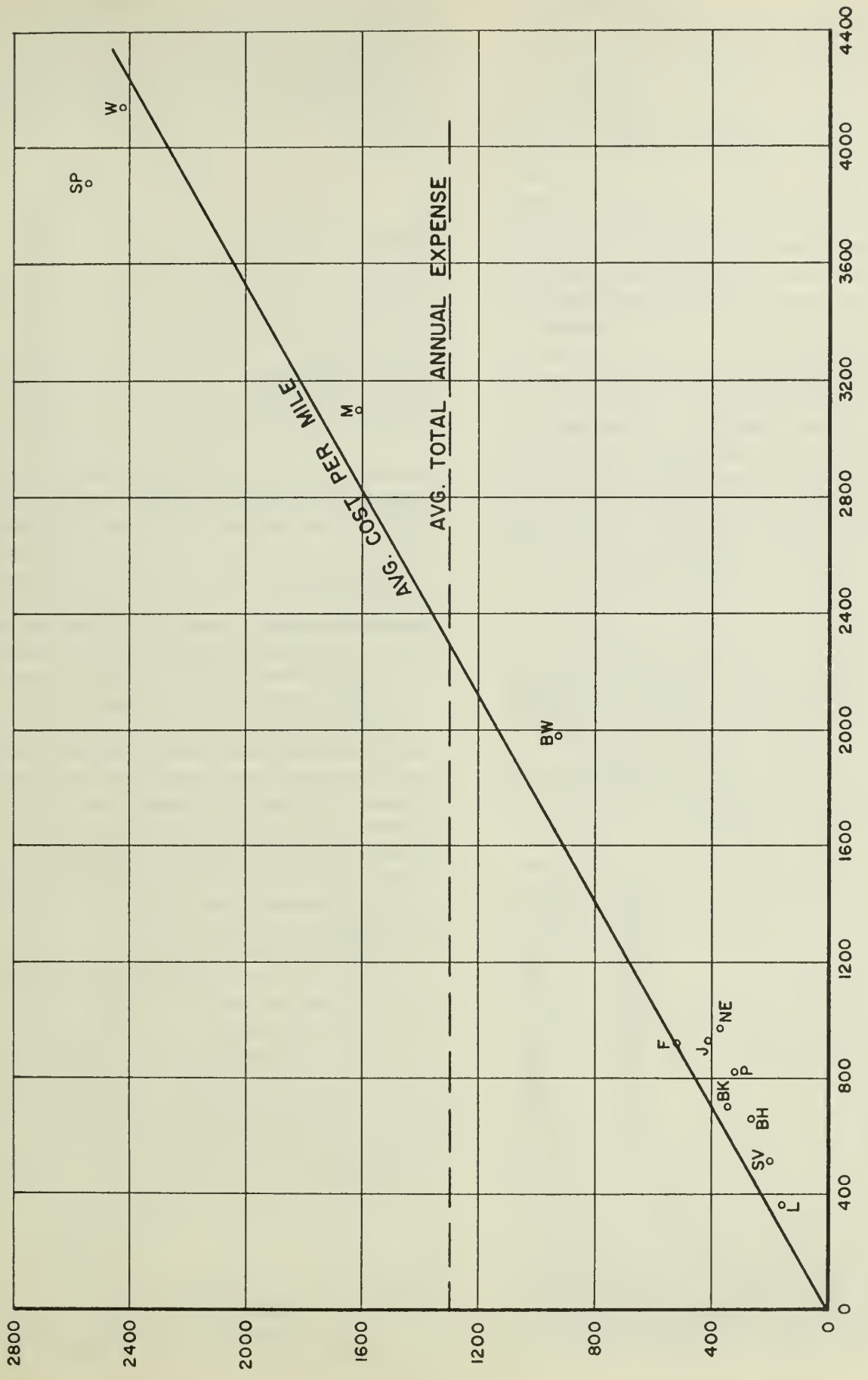

Total Annual Expense $(000)
AVG. TOTAL ANNUAL EXPENSE
AVG. COST PER MILE
W
SP
M
BW
F
J
NE
P
BK
BH
SV
L
2800
2400
2000
1600
1200
800
400
0
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000
4400
Bus Miles Produced (in thousands)

Figure 5

wherein the total system costs are to be recovered and profit is to be maximized.

A judgment that can be made solely on the basis of costs concerning an increase in service is the minimum amount of return that will induce management to make the increase. This amount can change as the system changes over time.

Long Run Costs

The costs that will be analyzed in this report are intended to be long run costs. Often, when a firm introduces a new product, it experiences start-up costs which "wash out" over time. Similarly, decisions can be made with respect to equipment and modes of operation wherein commitments have been made that cannot be quickly reversed or changed.

Long run costs are not costs as they were incurred for some one definite period of time for all kinds of firms. The long run costs for a steel company, for example, may refer to a much longer period of time than a taxicab company. The long run is a period of time in which a company has had the opportunity to reassess and change, if necessary, all of its policies including both operating procedures and capital investment. In order to approximate long run costs, the costs used in this report are bus company annual costs as they were incurred in the years 1960 and 1961.

The Use of Statistics in Cost Analysis

In this study, statistical analysis will be used solely to test the credibility of hypotheses with respect to how costs are influenced by factors that appear plausible. The principal statistical tool will be linear regression analysis.

By way of introduction to the technique, consider the total annual expenses for a selective group of Massachusetts bus companies during the years 1960, 1961:

TABLE 1

	1960 $(000)	1961 $(000)
Berkshire St. Ry. Co.	347	361
Eostern Moss. St. Ry. Co.	6,822	7,002
Fitchburg ond Leominster St. Ry. Co.	473	563
Plymouth ond Brockton St. Ry. Co.	303	345
Brush Hill Tronsportotion Co.	252	294
Johnson Bus Lines	413	399
Lynnfield Community, Inc.	159	169
Moss. Northeostern Tronsportotion Co.	374	370
Service Bus Lines	190	201
Worcester Bus Compony	2,559	2,269
Boston, Worcester & N.Y. St. Ry. Co.	962	899
Middlesex ond Boston St. Ry. Co.	1,731	1,484
Springfield St. Ry. Co.	2,539	2,540

The data in Table 1 are not very informative. About all that can be derived from such a table is that some companies are incurring a great deal more expense than others and that the expenses seem to be stable from one year to the next. In an effort to find the causal factors that influence a company's expenses, the hypothesis is made that such causes can be found if the relevant factors that create differences in the expenses among companies can be found. An often used technique is to hypothesize that the production of some one kind of output (say bus miles) is principally responsible for the variation in expense among companies and then test the hypothesis by forming the average cost per bus mile.

For the same companies, the average costs per mile are as follows:

TABLE 2

	1960	1961
Berkshire St. Ry. Co.	$.51	$.50
Eostern Moss. St. Ry. Co.	.61	.63
Fitchburg ond Leominster St. Ry. Co.	.52	.61
Plymouth ond Brockton St. Ry. Co.	.46	.36
Brush Hill Tronsportotion Co.	.40	.42
Johnson Bus Lines	.43	.46
Lynnfield Community, Inc.	.47	.45
Moss. Northeostern Tronsportotion Co.	.35	.42
Service Bus Lines	.37	.46
Worcester Bus Compony	.61	.55
Boston, Worcester & N.Y. St. Ry. Co.	.48	.46
Middlesex ond Boston St. Ry. Co.	.55	.48
Springfield St. Ry. Co.	.65	.66

During the years 1960-1961, the selected bus companies produced 60,210,000 total bus miles. The total expense for the same period was $34,022,000. The average cost per mile, therefore, was $.56. The use of the average cost per mile as an explanation for the variation in expense can be graphically displayed by plotting the expense versus miles graph and drawing a straight line through the origin with a slope that gives an increase of $.56 for every mile produced. Such a graph is shown in Figure 5. The horizontal (dotted) line is drawn at the companies' average cost.

If the miles produced by a given company is located on the horizontal axis, then the annual expense for that company, as estimated by the group's total average cost per mile, is the height of the average cost per mile line directly over the located point on the horizontal axis.

From observation of Figure 5 it can be seen that the use of an average cost per mile makes two assumptions:

1. Total expense can be represented as a straight line when plotted against miles.
2. When little or no bus miles are produced, little or no costs are incurred. Thus the industry would have no fixed cost and the total cost line would be drawn through the origin.

Figures 6A and 6B indicate how industry average cost per mile could fail adequately to explain cost variation. In Figure 6A total costs are linear but there is a fixed cost. In Figure 6B costs are curved or non linear.

Figure 6A

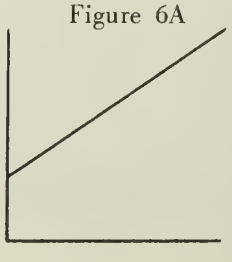
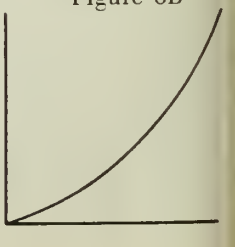
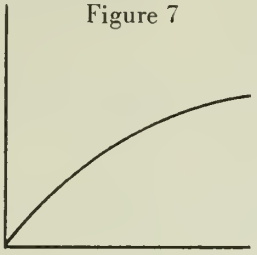


Figure 6B



Linear cost representations are usually assumed because, if the cost line were curved somewhere as in Figure 6B, smaller companies would have lower unit costs than larger companies and therefore could drive them out of areas where they compete by charging lower prices. If, on the other hand, the cost line were curved as in Figure 7, the larger companies

Figure 7



would have lower unit costs and could drive the smaller companies out of areas where they compete.

It has been pointed out that the existence of fixed costs in the industry also implies decreasing unit costs as production increases. Nevertheless, the marginal costs for the larger and smaller companies would be the same and, if only limited competition exists, the larger company cannot drive the smaller ones out.

In the cost analysis to follow, it will not be assumed that there are no fixed costs. However, an assumption of linearity will be made; that is, the hypothesis that certain factors are causally related to costs will be considered to be confirmed to the extent that a linear relationship exists.

Briefly, the linear regression technique is a means of determining the "best estimate" of a linear relationship between a factor and costs. The technique is designed to determine how much of the cost variation between companies is explained by the linear relationship. Generally, if a large proportion of the variation is explained by the linear relationship constructed, it will be concluded that there is a linear causal relationship if the proposed factor also appears plausible. Fuel consumption may be as closely related to costs in a statistical sense as are bus miles but it is clear that bus miles are more fundamental in a causal sense since fuel is generally consumed to produce bus miles.

To introduce the linear regression technique, Figure 8 below plots the graph of bus company costs against bus miles. Eastern Mass has been omitted because it cannot be placed on the graph while maintaining a separation between the smaller companies. From the graph it clearly appears that there is linear relationship between the two variables. On the graph two hypothetical linear relationships A and B have been drawn and both appear to depict the linear relationship reasonably well. The following points summarize the graph and relationships:

1. *Marginal Costs*

   Relationship A states that the cost to the industry for producing an extra mile is about $.60 while relationship B gives a marginal cost of about $.70.

2. Average Costs

   Both relationships show average or unit costs to be below marginal costs. For relationship A the average cost is about $.50 while the average cost for relationship B is $.60.

From the first point the conclusion can be drawn that visual inspection is not sufficient to determine the linear relationship. The second result is absurd; it states that an initial number of bus miles can be produced for no cost whatsoever. Thus bus miles alone cannot be sufficient to explain costs, not merely because no straight line would contain all the points but also because it leads to an absurdity. The implications of the second point will be returned to later.

The existence of several reasonably good estimates of the linear relationship that have significantly different results emphasizes the need for some explicit principles by which an estimating linear relationship is to be constructed. Linear regression is a technique that determines the linear relationship that minimizes the sum of the squares of the difference between the estimated cost (the height of the line above a given number of bus miles) and the actual cost experienced by a company that produced the given number of miles.

The reasons for choosing the minimum sum of squares principle for determining the linear estimate are too lengthy and complex to describe in this report. It is sufficient here to say that such a technique will give the best estimate of a linear relationship given certain assumptions concerning the distribution of costs and miles produced.

An often used measure to determine whether there is a linear relationship as determined by the regression technique between variables such as cost and miles is the coefficient of linear determination denoted by R^2. R^2 can assume only the values between zero and one and is a measure of how closely the plotted points cluster about the regression line. When all the points lie on the line, R^2 has the value one. When no straight line can be constructed that will estimate costs better than the average cost, R^2 has the value zero.

When R^2 is used as a measure for the adequacy of estimating a trend in the data by a straight line, particular care must be taken with the selection of the companies to be analyzed. The problem that arises is best illustrated by an example.

Table 3 lists the companies that are participating in the Mass Transportation Commission experiment. Their 1961 total costs and bus miles are also given.

For the selected bus companies in Table 3, the calculated R^2 is extremely high and makes the claim that all but less than one per cent of the variation in the costs can be explained in terms of a linear relationship with bus miles. Such a claim is extremely misleading, however, and can lead to a false confidence in the numerical relationship that is

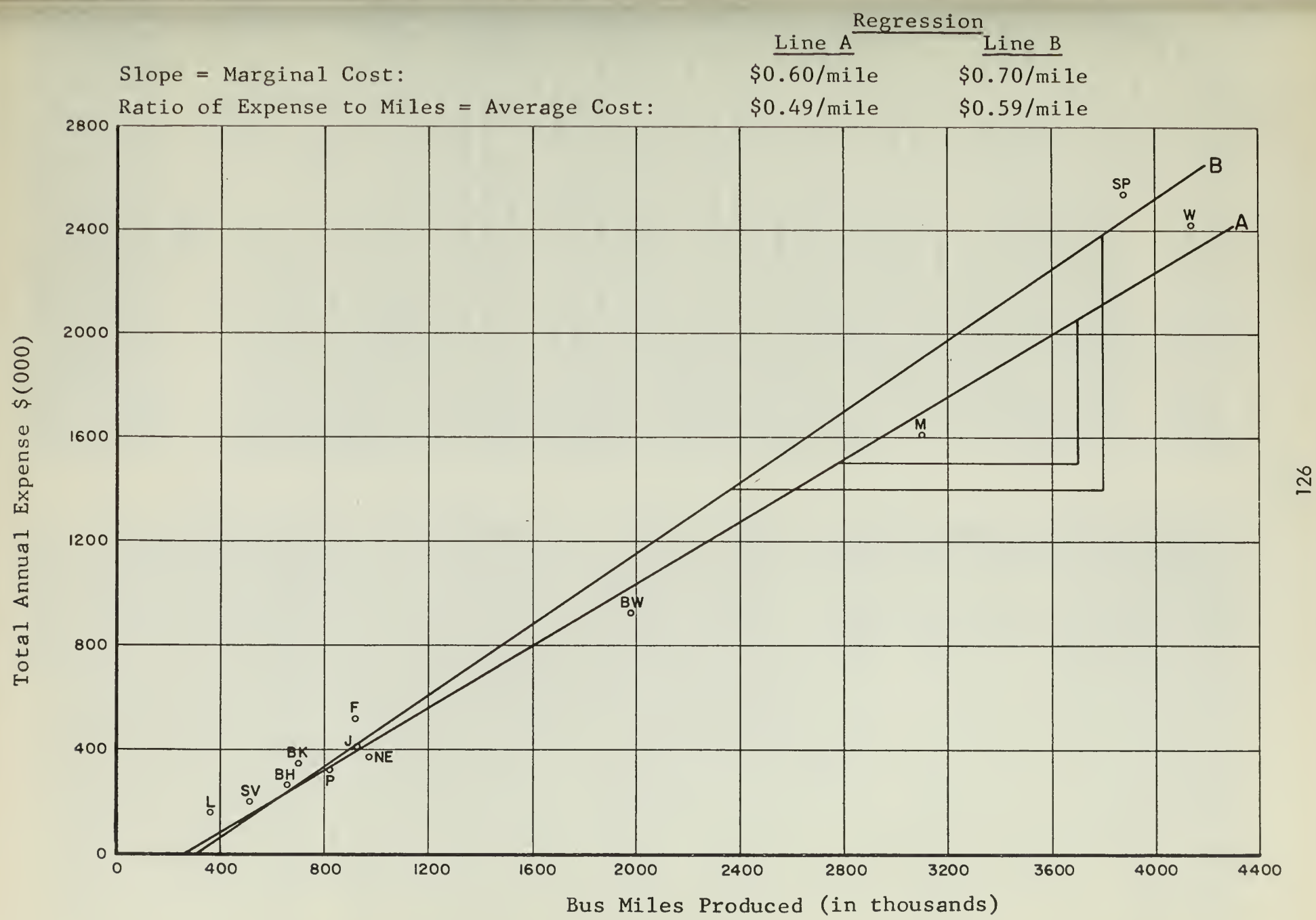

Regression
Line A
Line B
Slope = Marginal Cost:
$0.60/mile
$0.70/mile
Ratio of Expense to Miles = Average Cost:
$0.49/mile
$0.59/mile
Total Annual Expense $(000)
Bus Miles Produced (in thousands)
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000
4400
B
A
SP
W
M
BW
F
J
BK
NE
BH
P
SV
L

Figure 8

TABLE 3

	1960–61 Avg. Annual Expense $(000)	1960–61 Avg. Annual Bus Miles (in thousands)
Berkshire St. Ry. Co.	354	700
Eastern Mass. St. Ry. Co.	6,912	11,211
Fitchburg Leominster St. Ry. Co.	518	916
Plymouth-Brockton St. Ry. Co.	324	820
Brush Hill Transportotion Co.	273	605
Jahnsan Bus Lines	406	907
Lynnfield Community, Inc.	164	355
Mass. Northeastern Transportation Co.	372	909
Saugus Transit Co.	117	257
Service Bus Lines	195	507
Borre Bus Campony	36	130
Worcester Bus Co.	2,414	4,137

$R^2 = .995$

derived when there is a company in the group that is extraordinary large with respect to the others, in this case Eastern Mass.

In effect, the presence of such a large isolated company will nearly dictate the derived linear relationship. For example, suppose that Eastern Mass had incurred but 75% of its actual expenses, say, $5,185.000. If such were the case, there would be an R^2 of .987. In this latter case all but nearly one per cent of the variation is "explained" by bus miles but the linear relationship has altered.

The linear relationship derived with Eastern Mass at its true cost level states that bus miles are produced at a marginal cost of $.62 per mile while for the fictitious case, bus miles are produced at a marginal cost of $.47 per mile. If industry performance were calculated in this fashion, an extraordinarily large company could always claim to be conforming in costs because it would dictate the trend.

This example shows the need to incorporate more large bus companies so that a true trend rather than a spurious trend can be estimated. For this reason, three additional large companies are introduced in the analysis although they are not taking part in the experiment. These companies are the Boston and Worcester, Middlesex and Boston, and Springfield Street Railway. More large Massachusetts bus companies would have been desirable but none were available.

Including the above companies does not completely solve the problem of the size effect of Eastern Mass. While it is desirable to have Eastern Mass explained by the linear hypothesis, (i.e., have the straight line pass close to the Eastern Mass point on the graph), such an explanation should not differ significantly from the best explanation achievable when the large point is omitted.

On the basis of the augmented sample, the linear regression technique yields the following relationship between miles and cost:

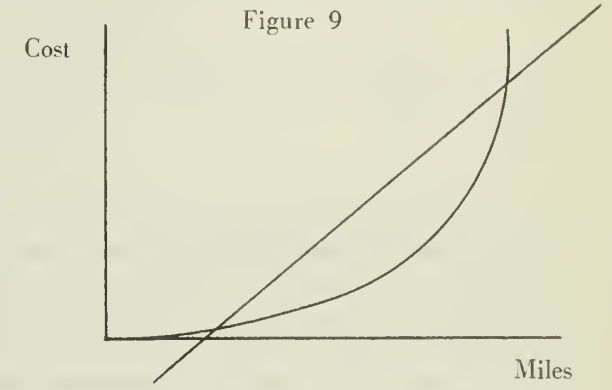
Total Annual Expense $= -\$136{,}700 + \$.6276$ per mile

$R^2 = .99$

This relationship states that the marginal cost of producing a bus mile is about $.63. It also gives the absurd result that a revenue of $136,700 can be obtained when no bus miles are produced; or alternatively, the first 218,000 bus miles can be produced at no cost.

The negative intercept in the above relationship can be explained in one of two ways: either the bus mile factor is not the only factor to influence cost, or if it is, then costs are not entirely linear with respect to bus miles and the cost line curves upward. Figure 9 illustrates this latter case.

Figure 9



The above curvilinearity, if it exists, has the effect that a company's marginal costs depend upon how large it is; that is, there are diseconomies to scale. If the above graph describes the cost relationship, the smaller companies should have lower marginal costs (the curve is less steep at the lower end). Performing a linear regression on the ten smaller bus companies gives the following result.

Annual Total Cost $= -\$16.320 + (\$.464)$ per bus mile

$R^2 = .87$

From this relationship, it would appear that the smaller bus companies enjoy a smaller marginal cost. The negative intercept is small and could result from statistical variation. Note also that R^2 has decreased. It would appear that R^2 is still a misleading measure of explanation because of the existence of bus companies at both extremes of size but very few in between. Table 4 below shows a comparison between the two linear regressions.

TABLE 4

Bus Miles (000)	COMPANY	Actual Annual Cost Average 60/61 $(000)	Est. Cost n = 15 $(000)	Ratio Est/ Actual n = 15	Est. Cost n = 10 $(000)	Ratio Est/ Actual n = 10
700	Berkshire St. Ry.	354	303	0.86	308	0.87
916	Fitchburg & Leominster	518	439	0.85	409	0.79
820	Plymouth & Brockton	324	379	1.17	364	1.12
665	Brush Hill	273	281	1.03	292	1.07
909	Jahnson	406	434	1.07	405	1.00
355	Lynnfield Com.	164	87	0.53	148	0.90
969	Moss. Northeastern	372	472	1.27	433	1.16
257	Saugus Transit	117	25	0.21	103	0.88
507	Service Bus Lines	195	182	0.93	219	1.12
130	Barre Bus Lines	36	−54	−1.50	44	1.22
4,137	Worcester Bus Co.	2,414	2,460	1.02		
11,211	Eastern Moss.	6,912	6,900	1.00		
1,982	Boston & Worcester	931	1,108	1.19		
3,103	Middlesex & Boston	1,608	1,811	1.13		
3,881	Springfield St. Ry.	2,540	2,300	0.91		
30,542		17,164	17,186	1.00		

The next section will give a further analysis of bus company costs. The analysis will proceed by separating those portions of company costs that are linearly related to production from those that do not appear to be. Of those that are not, an explanation will be given. Those costs that are linearly related to production will be broken into reasonable classifications and analyzed separately where they relate to separate causal factors.

Analysis of Bus Company Cost Accounts

Introduction

In the previous section it was shown that total annual expenses of the bus companies do not display a completely linear form and that bus miles did not appear to be adequate in and of itself to explain the difference in expense among bus companies. One possible approach to finding increased explanation of total expense would be to try various other production variables such as numbers of passengers carried by the companies and bus driver hours singly and in combination with bus miles. The result of such a trial might be satisfactory insofar as increased explanation might be found and the non-linearity disappear.

The above approach has, however, two principal difficulties. In the first place, not all of the components of a company's total operating expense may be affected by the production of some given factor. For example, the expense of fuel and oil may be solely related to bus miles and not, appreciably, to the number of passengers carried. If interest were centered in company operations that involve some but not all company expense areas, the total expense approach would be of limited assistance.

The second difficulty occurs when the number of companies to be analyzed is relatively small. For statistical reasons, it is desirable in such a case to keep the number of explanatory variables small. Thus, if several production variables are to be tried, it is advisable, if possible, to group expenses so that all expenses in a group do not appear to be affected by more than one or two factors.

Definitions and Expense Accounts

In the bus companies' annual reports to the Department of Public Utilities of Massachusetts, operating expenses are grouped according to areas of effort or function. The major groups are:

1. Equipment Maintenance and Garage Expense (account 4100)
2. Transportation Expense (account 4200)
3. Station Expense (account 4300)
4. Traffic Solicitation and Advertising Expense (account 4400)
5. Insurance and Safety Expense (account 4500)
6. Administrative and General Expense (account 4600)
7. Depreciation Expense (account 5000)

There are two principal reasons why the above grouping of expenses is not suitable for analysis: The existence of expense trade-offs among sub-accounts of different large expense areas; and the lack of uniformity of reporting of differences among corporate organizations.

Expense trade-offs can be exploited differently by different companies according to management's discretion. For example, management may decide to have a relatively new fleet of buses in order to reduce maintenance costs. In such a case, annual depreciation would increase. If companies decided the trade-offs differently, then the cost per mile (say) of one member of the trade-off would vary from one company to the next. The cost per mile of the sum of the two, however, would remain fairly constant among companies. All expenses that have such trade-offs, then, should be grouped together.

Lack of reporting uniformity and difference in corporate organization have an effect similar to the expense trade-off mentioned above. It often happens that within a company there are individuals who perform more than one task and, therefore, their wages must be allocated to more than one expense area. Such an allocation, of necessity, is often not exact. Insofar as the element of arbitrariness enters such allocation, the given accounts will not be explained well by any production factor. Several companies involved in the experiment record no expenses in the supervision of transportation and maintenance. Such supervision is, of course, performed and the expense is merged with the Administrative and General Expense. For this reason, Transportation and Maintenance Expense should be grouped with administrative expenses for the purpose of analysis.

Certain expenses may stand alone without ambiguity due to expense trade-offs or reporting decisions and should be analyzed separately. The separation and regrouping of expenses that was performed for this study was as follows:

1. Drivers' Wages
   This account is the total compensation of drivers as found in Schedule 9002 of the D.P.U. Annual Report. It differs slightly in some instances from the Drivers' Wages, Account 4220.
2. Maintenance
   This account is Account 4100, Equipment Maintenance and Garage Expense, less Account 4110, Supervision of Shop and Garage.
3. Transportation Expense
   This account consists of Accounts 4230, 4240, and 4250, fuel and oil for revenue equipment and purchased transportation. Account 4210, supervision, has been reassigned to General and Administrative Expense; Account 4220, Drivers' Wages, is handled independently; and Accounts 4261 and 4262, Road Expenses and Tolls, are accounts that are best left

unanalyzed because they are peculiar to a given bus company.

4. Depreciation Expense
   The depreciation of items necessary to produce transportation is included in this account. Included are: depreciation of revenue equipment; depreciation of service cars and equipment; depreciation of shop and garage equipment.

5. General and Administrative Expenses
   These expenses are those that are not allocable to distinct functions of the company. They consist of general reporting function expenses and overall company management expenses. In general, all expenses that are related to the size of the firm rather than any specific output such as bus miles or passengers carried are found in this account. In addition, accounts where reporting differences among companies occur are also found in this account. The accounts found under this general heading are:
   Account 4600: Administrative and General Expense
   Account 4110, 4210: Supervision of Maintenance and Transportation
   Account 4311: Salaries and Commissions under Station Expense
   Account 4500: Insurance and Safety
   All remaining depreciation accounts.

6. Unanalyzed Expenses
   The following expenses are left unanalyzed.
   Road Expenses and Tolls, Accounts 4361 and 4362;
   Rents, Account 5300;
   Taxes, Account 5200;
   Station Supplies, Repairs and Other Expenses, Accounts 4314, 4319, and 4332;
   Advertising and Commissions, Accounts 4400, 4331, 4340, and 4350.
   Insurance other than Public Liability and Property Damage, Account 4500 less accounts 4520 and 4530.

These expenses are discussed in detail following the analyzed expenses.

The following section discusses the above accounts in detail. The results were based on the larger group of bus lines referred to in the earlier section except that Saugus and Barre bus lines were omitted. The omission was made because these two companies reported expenses in an abbreviated short form.

Drivers' Wages

Drivers' wages constitute the largest single expense for the bus companies. Table 5 below shows the total average annual expense for drivers' wages and the percentage of drivers' wages to total operating expenses.

TABLE 5

	Average Annual Drivers Wages $(000)	Percent-Drivers' Wages to Total Expense
Berkshire St. Ry. Co.	130	37%
Eastern Massochusetts St. Ry. Co.	2,868	41
Fitchburg & Leominster St. Ry. Co.	191	35
Plymouth & Brockton St. Ry. Co.	90	28
Brush Hill Tronsportation Co.	77	28
Johnson Bus Lines	121	31
Lynnfield Community, Inc.	62	38
Moss. Northeostern Trons. Co.	123	33
Service Bus Lines	71	36
Worcester Bus Co.	1,076	42
Boston, Worcester & N.Y. St. Ry. Co.	297	31
Middlesex & Boston St. Ry. Co.	782	46
Springfield St. Ry. Co.	1,115	44

A linear regression was performed to discover the simple relationship between Drivers' Wages and bus miles. While a high R^2 was obtained, the result was unsatisfactory because the smaller bus companies were not explained adequately. For the bus companies above, the result of the linear regression was:

Annual Drivers' Wages = −$87,800 + $.269 per bus mile

$$R^2 = .99$$

In the above linear relationship there is a large negative intercept or fixed cost that may indicate that Drivers' Wages expense are not linear. Of course, the fixed element is relative to bus miles. To determine if another measurable variable was affecting this expense, several multiple regressions were tried which test for the linear effects of other variables in addition to bus miles. Because of the failure of the tested multiple regressions to reveal significant relationships to other variables, the hypothesis of curvilinearity was accepted.

Drivers' Wages are, of course, a function of the number of drivers' hours and the drivers' wages per hour. That wages per hour is not constant can be readily seen in Table 6.

TABLE 6

	Wages per Hour
Berkshire St. Ry. Co.	$2.03
Eastern Massochusetts St. Ry. Co.	2.17
Fitchburg & Leominster St. Ry. Co.	1.75
Plymouth & Brockton St. Ry. Co.*	1.73
Brush Hill Transportation Co.*	1.39
Johnson Bus Lines	1.88
Lynnfield Community, Inc.	1.37
Moss. Northeostern Trans. Co.	1.02
Worcester Bus Company	2.15
Boston, Worcester & N.Y. St. Ry. Co.	2.32
Middlesex & Boston St. Ry. Co.	2.12
Springfield St. Ry. Co.	2.26

*Drivers' Hours were reported for 1960 only. Service Bus Lines reported no Drivers' Hours for either 1960 or 1961.

Wages per hour is not the only possible source of variation. It is possible that the productivity of drivers may vary from company to company: because of differences in route

structure, traffic and work rules with regard to split shifts, it may happen that the drivers' hours consumed in producing a given number of bus miles may be higher for some companies than for others. In order to test whether such a variation exists, a linear regression between bus miles and drivers' hours was performed and the following relationship derived:

Annual Drivers' Hours = .122 hr. per mile −30,000 hrs

$R^2 = .99$

The above relationship still indicates some curvilinearity but the smaller bus companies are more adequately explained as can be seen in Table 7.

TABLE 7

	Actuol Drivers' Hours (000)	Estimoted Drivers' Hours (000)
Berkshire St. Ry. Co.	64	55
Eastern Mass. St. Ry. Co.	1,319	1,337
Fitchburg & Leominster St. Ry. Co.	59	81
Plymouth & Brockton St. Ry. Co.	49	70
Brush Hill Transportation Co.	51	51
Johnson Bus Lines	63	80
Lynnfield Community, Inc.	45	13
Mass. Northeostern Trons. Co.	121	88
Worcester Bus Co.	502	474
Boston, Worcester & N.Y. St. Ry. Co.	128	211
Middlesex & Boston St. Ry. Co.	370	348
Springfield St. Ry. Co.	492	443

Using the linear estimation of Drivers' Hours from bus miles, the following relationship is derived for Drivers Wages:

Annual Drivers'.Wages =

Wages

Drivers' Hours x (Drivers' Hours as estimated by bus miles)

Wages

Drivers' Hours x (.122 hours per bus mile −30,000 hrs.)

The large negative intercept of 30,000 hours is the result of curvilinearity in the graph. In general, it is found that the smaller companies are overestimated by the above equation. In general, it can be said that the smaller bus companies enjoy a productivity advantage in that they have less Drivers' Hours consumed per bus mile. This situation could be the result of a great flexibility in splitting drivers' shifts. Table 8 below lists the estimated Drivers' Hours and Drivers' Wages.

TABLE 8

	Average Annuol Hours (000)		Average Annuol Drivers' Wages $(000)	
	Actuol	Est.	Actuol	Est.
Berkshire St. Ry. Co.	64	55	130	112
Eastern Mass. St. Ry. Co.	1,319	1,337	2,868	2,901
Fitchburg & Leominster St. Ry.	59	81	191	142
Plymouth & Brockton St.Ry.Co.	49	70	90	121
Brush Hill Tronsportotion Co.	51	51	77	71
Johnson Bus Lines	63	80	126	150
Lynnfield Community, Inc.	45	13	62	18
Moss. Northeastern Trans. Co.	121	88	123	90
Worcester Bus Lines	502	474	1,075	1,019
Boston, Worcester & N.Y.	128	211	297	490
Middlesex & Boston St. Ry. Co.	370	348	782	738
Springfield St. Ry. Co.	492	443	1,115	1,001

The factor, wages per driver hour, is left unanalyzed a a rate that is negotiated by the drivers and the individua companies. To the extent that a company must purchas off-peak service driver time, the company has a joint cost It may be that some of the companies whose driver hour are overestimated have not had an opportunity to utilize th jointly purchased off-peak driver time. It will be recalle from the first section that no separate marginal costs ca be assigned to peak and off-peak hours and that an hypothetical assignment reflects a pricing decision, not a cost finding.

Maintenance, Transportation, and Depreciation Expenses

These three accounts will be discussed as a group becaus of the possibility of there being expense trade-offs amon them. Expenditures on fuel and oil, for example, may depen upon the age of the equipment and level of maintenance a well as the bus miles produced by the equipment.

In order to determine whether such trade-offs exist, th procedure followed was to make a tentative grouping of th relevant accounts into the three areas. Because all three area are closely related to the same outputs, such as bus miles it would not be surprising to find that the level of expens in one area closely correlated to the level of expense i another area. In order to claim that there are such trade offs, it must be found that a regression produces a greate reduction in the variation among company expenditures fo the sum of the areas than the sum of the variations fron the individual areas regressed separately.

If poor choices are made for the grouping of costs int the three areas, it can often happen that the result will be a reduction of variation when the accounts are aggregated There is a certain amount of trial and error in the aggrega tion of accounts wherein a judgment must be made as t whether certain accounts should be related to the sam variable.

Regressions were performed individually upon the thre cost areas separately and in combination. In addition, al regressions performed twice, once with Eastern Mass include and once without it in order to evaluate its biasing effect

It was found that with the expense areas so defined, there was little or no trade-off between them.

Depreciation expense is a function of the size of the companies' fleet and the age of the equipment. Nevertheless there appears to be a fairly good relationship between this expense and bus miles. This relationship may, however, be a reflection of a relationship with firm size.

The regression derived without Eastern Mass was:

Annual Depreciation Expense = −$9,200 + $.039 per bus mile

$R^2 = .91$

The negative intercept above tends to show that the smalle bus companies are operating older equipment. Including

Eastern Mass, the derived regression was substantially the same:

Annual Depreciation Expense = −$6,800 + $.038 per bus mile

$R^2 = .97$

From the above results concerning depreciation, it would appear that depreciation expense must be related either to public convenience or to cost per passenger mile. This latter variable is not available, however, and the product of passengers and miles is an inadequate substitute. Such a cost figure would depend upon the size of the bus and the load factor.

Maintenance expense was found to give the same results regardless of whether Eastern Mass was included or not. The derived relationship is:

Annual Maintenance Expense = −$5,000 + $.095 per bus mile

$R^2 = .99$

Transportation expense is principally the expense for fuel and oil. Somewhat different results were achieved when Eastern Mass was included than when it was deleted.

Including Eastern Mass, the regression derived was:

Annual Transportation Expense = $8,000 + $.028 per bus mile

$R^2 = .97$

The result derived without Eastern Mass was:

Annual Transportation Expense = −$3,800 + $.036 per bus mile

$R^2 = .957$

The difference in the two equations could be due to statistical variation due to minor causes such as the relative traffic congestion of the routes. Table IX below summarizes the results of the regressions. All companies have had their expenses estimated from the smaller sample except Eastern Mass.

TABLE 9

	Maintenance $(000)		Transportation $(000)		Depreciation $(000)	
	Actual	Est.	Actual	Est.	Actual	Est.
Berkshire	53	61	21	21	10	19
Fitchburg & Leominster	121	81	36	29	22	27
Plymouth & Brockton	74	72	22	25	32	23
Brush Hill	58	58	30	20	33	17
Johnson	62	81	27	28	42	27
Lynnfield	26	29	10	9	13	5
Mass. Northeastern	85	86	30	31	12	29
Service	43	43	16	14	10	11
Worcester	385	385	166	144	150	154
Eastern Mass.	1,079	1,074	298	315	411	419
Boston-Worcester	207	182	54	67	56	69
Middlesex	228	288	96	107	78	113
Springfield	395	361	124	135	179	144

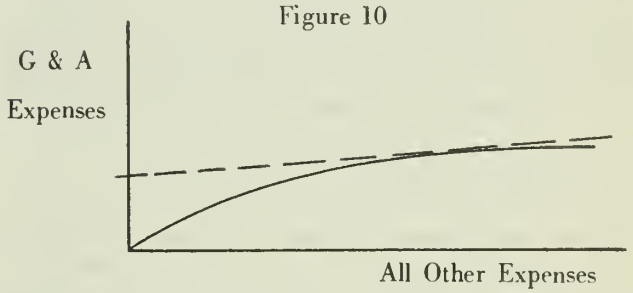
General and Administrative Expense

General and administrative expenses are those expenses that are not related in a direct causal sense to a company's productive output. Theoretically, transportation could be provided without incurring these expenses. If a company attempted to provide transportation without incurring such expenses, however, expenses in other areas would climb rapidly due to lack of administrative coordination and control, profits might decline because of continuation of undesirable scheduling, and certain necessary legal requirements for items such as outside audits would not be performed.

While this account has a relationship to revenue, it will be considered here solely in its function of controlling other expenses. The relationship hypothesized will be a linear relationship between this account and all other expenses.

In general, the linear relationship suggested here is not considered adequate for this type of account because there are economies to scale. When there are economies to scale, the relationship can be pictured as in figure 10 below.

Figure 10



The solid line in figure 10 represents the true relationship between General and Administrative Expenses and all other expenses when there are economies to scale. The dashed line represents the regression line. The slope of the regression line is the marginal cost of the account for companies that are operating in the portion of the curve that is nearly a straight line. The regression line would make it appear that there are fixed costs in this account, whereas all expenses in the account are variable.

The expenses in this account could be represented by a second order equation and a closer estimation could be derived for each firm. Such an estimation has little value, however, and the linear regression will give the marginal cost for the larger firms.

The derived linear regression is:

Annual General and Administrative Expenses = $21,000 + $.176 per dollar of all other expenses

$R^2 = .94$

This regression was derived without including Eastern Mass. When Eastern Mass was included the regression result is:

−$32,000 + $.217 per dollar of all other expenses

$R^2 = .98$

Because of the unique nature of Eastern Mass previously described and also because the first relationship derived above conforms more closely to the results predicted on theoretical grounds, the first relationship is used in Table 10 below except for Eastern Mass.

TABLE 10

	Annual G&A Expense $(000)	Annual Other Expense $(000)	Estimated Annual G&A $(000)
Berkshire St. Ry. Co.	89	265	68
Eastern Moss. St. Ry. Co.	1,264	5,649	1,196
Fitchburg & Leominster St. Ry. Co.	119	435	98
Plymouth & Brocktan St. Ry. Co.	43	282	71
Brush Hill Transportation Co.	28	246	64
Johnson Bus Lines	62	344	82
Lynnfield Community, Inc.	19	146	47
Moss. Northeastern Trons. Co.	49	324	78
Service Bus Lines	23	173	51
Worcester Bus Co.	377	2,172	403
Bostan, Warcester & N.Y. St. Ry. Co.	211	746	152
Middlesex & Boston St. Ry. Co.	225	1,470	280
Springfield St. Ry. Co.	407	2,133	396

Examination of Table 10 shows the smaller companies to be generally overestimated. Fitchburg and Leominster and Boston-Worcester appear to have abnormally large expenses. Much of their excess expense can be traced to large expenditures in transportation and maintenance supervision.

Public Liability and Property Damage Expenses

This account presents difficulties for analysis because it contains a large discretionary element. Management has a choice with respect to the amount it wishes to be insured for and the size of the claims it wishes to settle by direct payment. The latter may have a trade-off with General and Administrative legal expenses.

Furthermore, while past safety experience of a given company may have some relevance to this account, a large consideration is given to company revenue. From these considerations, the expenses in this account might be left unanalyzable because no clear causal relationship is assured. Nevertheless, an analysis is given below that relates these expenses to company revenue. Once again a distinction is made between Eastern Mass and all other companies.

The regression obtained by excluding Eastern Mass is given as follows:

Annual Public Liability and Property Damage Expense = $12,000 + $.036 per dollar of revenue

$$R^2 = .82$$

When Eastern Mass is included, the regression is:

Annual Public Liability and Property Damage Expense = −$6,000 + $.041 per dollar of revenue

$$R^2 = .96$$

Table 11 below gives the numerical results of the regression. All companies are estimated using the first equation above, except Eastern Mass which is estimated by the second equation.

TABLE 11

	Average Annual Revenue $(000)	Average Annual Insurance $(000)	Estimated Insurance $(000)
Berkshire St. Ry. Co.	344	22	19
Eastern Mass. St. Ry. Co.	6,907	294	280
Fitchburg & Leominster St. Ry. Co.	524	12	25
Plymouth & Brockton St. Ry. Co.	365	25	19
Brush Hill Transportotion Co.	298	17	17
Johnson Bus Lines	397	26	21
Lynnfield Community, Inc.	159	16	12
Moss. Northeastern Trons. Co.	360	33	19
Service Bus Lines	198	20	13
Worcester Bus Lines	2,642	137	101
Bostan, Worcester & N.Y.	919	26	39
Middlesex & Bostan St. Ry. Co.	1,738	42	69
Springfield St. Ry. Co.	2,579	90	99

Unanalyzed Expenses

Table 12 below lists the average annual expenses that have been left unanalyzed.

Advertising and commission expenses are largely discretionary expenses; that is, they need not be incurred in order to provide transportation. Primarily, these expenditures are made in order to stimulate demand for transportation and thus increase revenue.

Theoretically, advertising expenses are not related to past or current traffic but rather to the ability to stimulate future traffic. The principle which should govern the outlay of an advertising dollar is easy to state: an advertising dollar should be spent when the discounted future profit it creates is greater than one dollar. The principle is extremely difficult to apply, however, because it requires knowledge respecting that part of the revenue that advertising is responsible for. Because of this difficulty, the principle is often ignored in practice and a certain small portion of revenue is allocated for this expense.

The expenditures made by the selected bus companies vary greatly from company to company and no relationship was found between these expenses and traffic, or revenue or profit. For this reason, this set of expenses is left unanalyzed.

Road and station expenses are relatively small and have been left unanalyzed because they are peculiar to each companies' route structure.

Insurance other than Public Liability and Property Damage has been left unanalyzed because it is a highly discretionary account.

Taxes form a fairly large portion of total expenses and it might be supposed that Social Security tax and Fuel tax would relate closely to employee compensation and fuel expenses respectively. A regression was performed that determined the relationship between Social Security tax and employee compensation. The result was as follows:

Average Annual State and Federal Social Security Tax = $250 + $.036 per dollar of employee compensation

$$R^2 = .99$$

TABLE 12

	Advertising and Commissions $(000)	Road and Station Expense $(000)	Insurance $(000)	Taxes $(000)	Rents $(000)
Berkshire St. Ry. Co.	2	0	6	27	–3
Eastern Mass. St. Ry. Co.	38	16	89	559	35
Fitchburg & Leominster St. Ry. Co.	16	0	12	39	1
Plymouth & Brockton St. Ry. Co.	16	0	5	24	4
Brush Hill Transportation Co.	2	0	3	19	7
Johnson Bus Lines	12	0	6	32	14
Lynnfield Community, Inc.	1	0	4	16	0
Mass Northeastern Trans. Co.	3	2	5	34	2
Service Bus Lines	2	1	3	10	0
Worcester Bus Lines	16	7	34	185	8
Boston, Worcester & N.Y. St. Ry. Co.	4	5	27	76	3
Middlesex & Boston St. Ry. Co.	10	0	57	130	1
Springfield St. Ry. Co.	16	0	34	179	5

Not surprisingly, the above relationship states that the tax rate is 3.6 per cent. When drivers' wages are estimated, the tax should be added to give total expense.

Fuel tax, on the other hand, shows a poor relationship to fuel expenses and reporting differences between companies is suspected. This account is much better estimated by use of published tax rates.

Rent expenses are discretionary in the sense that there is a trade-off between this account and capital accounts. Those companies that incur rents suposedly can at least recoup the rent expenses by employment of their funds in other capital items.

Conclusion

It has been found that, with the exception of Drivers' Wages and General and Administrative expenses, the non-discretionary accounts are analyzable in the sense that these expenses can be considered linear. Furthermore, the linear accounts have no significantly large fixed expenses and, therefore, they have no economies to scale. These accounts, therefore, give bus companies no incentive to provide service at less than average unit cost.

General and Administrative expenses were found to have economies to scale. The larger bus companies enjoy a small advantage in that it costs them less to control additions to operating expenses than it costs the smaller companies. It is difficult to say how much less. The average cost for the industry to control operating expenses is $.196 per dollar of operating expense. The marginal cost was found to be $.181, a difference of 1.5 cents. A reasonable guess might be that it costs the larger companies about 2 cents per dollar of operating expense less than it costs the smaller bus companies.

Drivers' Wages throughout the industry shows a complicated structure. The larger bus companies appear to be unable to obtain the productivity, in the sense of bus miles per driver hour, that the smaller companies achieve. The last remark must be qualified by consideration of individual route structure however. Nevertheless, it is possible that the larger companies may have a joint cost situation in that they may not be able to purchase driver hours for peak service periods without also purchasing a fixed proportion of off-peak hours because of negotiated work rules.

For those companies that do have such a joint cost situation, there is an incentive to provide transportation at less than average cost.

Appendix B

Detailed Analyses of

MTA Parking Lot Experiments

A. "Park and Ride" Experiments

1. *Parking at Rapid Transit Stations*

The MTA owns and operates a total of 6,344 parking spaces in 26 lots adjacent to its rapid transit stations. Over the past several years, the average daily number of cars parked at MTA parking areas was as follows:

From Table 1, it will be seen that the number of cars parked at MTA lots increased during the period 1958-1961, but at a declining rate, and then decreased in 1962. During this period, nearly 50 per cent of MTA parking spaces were vacant on an average day.

It was on the basis of this trend, that the MTC suggested a reduced fee parking lot experiment in order to test the possibility of attracting more fare box income through lowered parking rates.

Though specific terms vary among the six lessees who each operate one or more MTA parking lots, the typical lessee pays as rent 40 per cent of cash receipts on an agreed-upon

TABLE 1

METROPOLITAN TRANSIT AUTHORITY

PARKING LOTS – AVERAGE DAILY NUMBER OF CARS PARKED

Year	Number of Lots Operated	Number of Spaces Available	System Parking Fee	Average Daily Cars Parked	Change from Year Previous	Per Cent of Spaces Occupied
1958	19	3,890	25¢	2,700		69%
1959[a]	28	6,224	25¢	3,160	+17%	50
1960	28	6,224	35¢	3,460	+10	56
1961	28	6,224	35¢	3,600	+ 4	58
1962	28	6,224	35¢	3,500	– 3	56
1963[c]	29	6,394	[b]	4,000	+14	63
1964	26	6,344	[b]	4,200	+ 5	67

[a] Highland Branch opened July 4, 1959 with 2,304 new spaces.

[b] Reduced fee "park and ride" experiment in effect.

[c] An additional 1,635 spaces are available in 7 privately operated lots adjacent to MTA stations.

Source: MTA-MTC.

minimum, representing an average rate of occupancy. In the event income exceeds this average, 70 per cent of the excess is paid as rent. Under such a leasing procedure, maximum cash income to the lessee results when comparatively high parking fees are charged. However, since the MTA's share of the parking fee is much less than the fares paid per car, the MTA stands to gain more income when comparatively low parking fees are charged, if this latter stimulates increased utilization of MTA parking facilities.

The comparison between the potential gain in income from fares and the cost, in terms of reduced lease income, of reducing parking fees is as follows:

As Table 2 shows, the potential gain in fare box revenue through increased parking was from three to seven times the amount which it was judged parking fees would have to be reduced in order to attract additional patronage. That is, in order to justify a permanent reduction in parking fees, parking volume would have had to increase between 13 per cent and 27 per cent. In fact, as a result of the reduced fee parking experiment, parking on lines where fees at some lots were reduced, increased over 50 per cent.

Meanwhile, parking at five locations in no way related to the experiment, which served as a control group, decreased at an annual rate of 5 per cent or roughly the general rate of decline experienced throughout the MTA system.

On the average, MTA income from fares from cars parked at MTA parking lots, is five or more times the income to the MTA from parking leases. It was assumed, therefore that filling as many of the available parking spaces as possible, rather than trying to produce the maximum parking lease income, would produce the maximum in total income, from both fares and leases, for the MTA.

Prior to the introduction of experimental reduced parking fees there was no reliable indication as to what the effect of such a fee reduction might be on the number of cars using MTA lots. If a reduction in fee produced no increase at all in the volume of parking, then it would have been safe to conclude that the 35¢ fees were producing the maximum possible income from park and ride patronage for the MTA.

The parking fee at eight MTA lots having substantial vacancies was reduced from 35¢ to 10¢ during the experimental period: April 1, 1963 - February 11, 1964. The result of this experimental reduction in MTA parking fees is presented statistically in Table 3, which compares January 1963 parking volume with the volume 12 months later. Stated in simplest terms, there was an overall increase of 900 cars, or 50 per cent, along the three lines affected by the fee reduction.

The experiment provides several valuable lessons about the economics of park and ride patronage, together with some clues as to what steps can be used to induce the motorist to park his car before entering the congested downtown area.

First and most important, during the experiment the number of cars parked on an average day increased by 900 cars when compared with the same in the previous year. This increase, as shown in Table 4, represents an increase of $180,000 per year in new income from fares paid by parking lot patrons. Against this increase must be weighed the cost to the MTA, in terms of reduced income from leases, because of the reduced parking fee. This reduced income, at the time of writing, amounts to about $15,000 annually. That is to say, that the increase in park and ride patronage has already produced an increase in MTA annual income of $165,000. Preliminary figures for March 1964 suggests that this increase is continuing despite slightly increased fees at some lots. If the remaining 1,800 vacant spaces at MTA parking lots can be filled, an additional $330,000 annually in new income would be produced. This suggests that a total of almost one-half million dollars in annual MTA income could be generated if the right combination of price and convenience can be found.

TABLE 2

METROPOLITAN TRANSIT AUTHORITY

FINANCIAL EFFECT OF REDUCED PARKING FEES

Parking Lot	1962 Fee	Proposed Reduced Fee (1963)	Cost to MTA of Reduced Fee[a]	One Way Fare to Boston	Fare Revenue per Car Parked[b]	Cars necessary to offset Reduction in Parking fee
Riverside Woodland	35¢	10¢	14¢	40¢	$1.04	+13%
Brookline Village	35¢	10¢	14¢	30¢	.78	+18
Beachmont Suffolk Downs Orient Heights Wood Island Butler Street	35¢	10¢	14¢	20¢	.52	+27

[a] 70 per cent of parking fee paid to MTA as rent. This loss in parking lease income was compensated by MTC payments during the experimental period.

[b] Round-trip fare times 1.3 passengers per car.

Source: MTA-MTC.

TABLE 3

METROPOLITAN TRANSIT AUTHORITY
DAILY AVERAGE NUMBER OF CARS PARKED IN 20 MTA LOTS
JANUARY 1963 vs. JANUARY 1964

	Capacity of Lot	Daily Average Cars Parked 1963	Daily Average Cars Parked 1964	Per Cent Increase (Decrease)	1964 Per Cent Occupancy
Riverside Line					
*Riverside	1,600	315	605	92%	38%
*Woodland	390	275	365	33	94
Waban	42	38	37	(3)	100[a]
Eliot	57	49	44	(10)	100[a]
Chestnut Hill	55	30	35	17	100[a]
*Brookline Village	160	94	147	56	92
	2,304	800	1,233	54%	54%
Revere Line					
Wonderland	480	316	294	(7)%	61%
Ocean Ave.	175	110	83	(25)	47
*Beachmont	210	62	160	158	76
*Suffolk Downs	120	35	96	174	80
*Orient Heights	260	118	153	30	59
*Wood Island Park	500	149	294	97	59
	1,745	790	1,080	37%	62%
Mattapan Line					
Mattapan	220	137	159	16%	72%
Milton	32	29	24	(17)	100[a]
*Butler Street	320	96	250	161	78
	572	262	433	65%	76%
Sub Total	4,621	1,852	2,746	48%	60%
Control Group					
Arlington Heights	60	45	49	9%	82%
Everett	460	368	322	(13)	70
Kendall	115	105	115	10	100
Sullivan	200	156	154	(1)	77
Lechmere	360	330	315	(5)	88
	1,195	1,004	955	(5%)	73%
Total	5,816	2,856	3,701	30%	64%

Fee in January 1963 was 35¢ for all lots. Lots marked with asterik were experimentally reduced to 10¢ from April, 1963 to February, 1964.

[a] Based on field observations. Collectors on duty in a.m. only.

Source: MTA-MTC.

The second conclusion is that, given proper publicity and comparable convenience of access, park and ride patrons can be induced to shift from their habitual station to another nearby station. The 25¢ price differential between parking lots at adjacent rapid transit stations caused a considerable shift in parking habits. Over one hundred cars moved from Wonderland and Ocean Avenue to Beachmont when the fee at Beachmont was reduced by 25¢. This knowledge can be valuable, if, as was the case at several MTA locations, one lot is filled regularly to capacity, while another nearby lot has substantial vacancies. If cars can be shifted to a lot with a slightly less convenient location by means of pricing, then it would be possible to equalize the number of vacancies at adjoining lots so that each would have available space on days, such as days of evening store openings, when demand for parking is high.

The third apparent lesson learned during the reduced fee parking lot experiment is that publicity and advertising may play a major part in the developing of park and ride patronage. The increase of 170 cars at Butler Street, which occurred in a week or two after the announcement of the reduced fee parking experiment, was accomplished by no corresponding decrease in any of the MTA or private parking lots along the Mattapan-Harvard rapid transit line. It seems probable that this new patronage was generated from automobile commuters who formerly parked their cars in downtown Boston. The Butler Street lot in question is located on a side-street in a residential area and apparently the South Shore commuters, who now fill it to capacity daily, simply did not know where it was.

On the basis of what was learned during the reduction of parking fees from 35¢ to 10¢ it was attempted to develop a theory which could be used to adjust parking fees so that the maximum amount of patronage would result.

First, it was assumed that where a very high proportion of spaces at a given lot were occupied on a daily average basis, potential parkers were being turned away on busy days. It was decided to suggest raising parking fees at lots where there were few vacancies. At the same time, the experiment demonstrated that increased parking at lots having many

TABLE 4

METROPOLITAN TRANSIT AUTHORITY
DAILY INCREASE IN FARE BOX REVENUE FROM
"PARK AND RIDE" PATRONS
JANUARY 1963 vs. JANUARY 1964

	(Decrease) or Increase in Number of Cars	One-Way Fare to Baston	Daily Increase in Fare Revenue[a]
Riverside Line			
Riverside	290	40¢	$301.60
Woodland	90	40¢	93.60
Brookline Village	53	30¢	41.34
	433		$436.54
Revere Line			
Wonderland	(22)	20¢	$(11.44)
Ocean Avenue	(27)	20¢	(14.04)
Beachmont	98	20¢	50.96
Suffolk Downs	61	20¢	31.72
Orient Heights	35	20¢	18.20
Wood Island Park	145	20¢	75.40
	290		$150.80
Mattapan Line			
Mattapan	22	20¢	$ 11.44
Butler Street	154	20¢	80.08
	176		$ 91.52
TOTAL	899		$678.86
			× 264 days[b]
			= $179,219 yearly
			@ 15,000 monthly

[a] Cars Parked times Round Trip Fare times 1.3 Passengers per car.

[b] Operating days per year (Saturdays, Sundays and Holidays counted as ¼ day).

Source: MTA-MTC.

vacancies could be encouraged by reducing fees at those lots. The number of remaining vacant spaces in January 1963, before the experiment, and in January 1964, after the experiment had been in effect for nine months are shown in Table 5.

Of the approximately 6,000 MTA parking spaces, 2,000 were still vacant at the end of 1963. In an attempt to fill these remaining vacant spaces a new sliding scale of MTA parking fees was proposed as a replacement for the previous system-wide fee system. Using the knowledge gained that vacant spaces could be filled through lower parking fees, and that cars could be shifted from lot to lot by creating a difference in price between lots, the per cent of occupancy for each lot in January 1964 was examined.

The following tentative hypothesis was used in establishing parking lot prices (assuming the experimental fees as a base).

... Where occupancy is 85 per cent or more, *raise* the fee.

... Where occupancy is 74 per cent or less, *lower* the fee.

... Where occupancy is 75 to 84 per cent, do not change the fee.

Occupancy is calculated as the average daily cars parked divided by the capacity of the lot.

The results of applying this principle to the MTA parking lots is the schedule of fees in the column marked "Parking Fee March 1964".

TABLE 5

METROPOLITAN TRANSIT AUTHORITY
EFFECT OF FEE CHANGES AT 20 MTA "PARK AND RIDE" LOTS

	Capacity of Lot	Parking Fee January 1963	Vacant Spaces January 1963	Parking Fee January 1964	Vacant Spaces January 1964	Parking Fee March 1964	Vacant Spaces March 1964
Riverside Line							
Riverside	1,600	35¢	1,285	10¢	995	10¢	834
Woodland	390	35¢	115	10¢	25	25¢	180
Waban	42	35¢	0	35¢	0	35¢	0
Eliot	57	35¢	0	35¢	0	35¢	0
Chestnut Hill	55	35¢	0	35¢	0	35¢	0
Brookline Village	160	35¢	66	10¢	13	35¢	9
	2,304		1,466		1,033		1,023
Revere Line							
Wonderland	480	35¢	164	35¢	186	25¢	158
Ocean Avenue	175	35¢	65	35¢	92	25¢	50
Beachmont	210	35¢	148	10¢	50	15¢	29
Suffolk Downs	120	35¢	85	10¢	24	15¢	7
Orient Heights	260	35¢	142	10¢	107	25¢	124
Wood Island Park	500	35¢	351	10¢	206	15¢	148
	1,745		955		665		516
Mattapan Line							
Mattapan	220	35¢	83	35¢	61	35¢	40
Milton	32	35¢	0	35¢	0	35¢	0
Butler Street	320	35¢	224	10¢	70	15¢	0
	572		307		131		40
Control Group							
Arlington Heights	60	35¢	15	35¢	11	35¢	10
Everett	460	35¢	92	35¢	138	35¢	58
Kendall	115	35¢	10	35¢	0	50¢	0
Sullivan	200	35¢	44	35¢	46	50¢	72
Lechemere	360	35¢	30	35¢	45	50¢	72
	1,305		191		240		212
TOTAL	5,926		2,919		2,069		1,791

For a given station, MTA fares have remained constant during the experimental period.

Source: MTA-MTC.

Instead of charging a 35¢ parking fee at all locations, it was suggested that the fees be varied from free to 50¢. This would reflect the fact that there is more demand for parking at, say, Kendall, than at Riverside. If this simple relationship of supply and demand were reflected in MTA parking rates, it was hypothesized, maximum utilization of parking spaces would result, with a consequent increase in income from park and ride patronage.

It is recognized that ideally the MTA should have such a large supply of parking spaces that complete occupancy would result only when the parking fee was either 10¢ or free, but given the restricted number of MTA parking spaces available today, the above formula provides a method for producing the maximum possible rental income without any detrimental effect on income from fares. During the period of the present MTA leases with the parking lot experiments, which run until 1969, it is not practical to make parking free at any major location.

It is also true that having a man on duty, even if he collects only 10¢ from each car, has the advantage of providing supervision at the lot so that haphazard parking of cars, as well as vandalism, are prevented. If it is possible to expand the number of MTA parking spaces, more consideration will have to be given to free parking areas, as well as to the use of coin-operated automobile parking gates for control of parking patronage.

During the MTC's participation in the MTA reduced fee parking lot experiment, a monthly payment was made to the MTA representing the amount of income from parking which the MTA had "lost" through charging a lower parking fee. However, the increase in "Park and Ride" patronage, as shown above, was so substantial that the increase in MTA fare box revenue from these new customers more than offset the "cost" of lowering parking rates. On this basis, it was decided the MTA should be able to go ahead on its own with a permanent program of "customized" parking rates based on its supply and demand formula. Negotiations with parking lot lessees revealed that it would be possible to make effective a sliding scale of parking rates without any major change in the parking leases, since the increase in income at lots where a higher fee was proposed would tend to offset the loss at other lots where a lower fee was planned.

The sliding scale of MTA parking rates went into effect Wednesday, February 12, 1964. On the previous Monday, the driver of every car entering an MTA parking lot received a flyer which explained the rationale for the new sliding scale of parking rates and presented these new rates alongside the old pre-experiment 1962 prices in tabular form.

While it is too early to judge the true impact of this new parking fee program, there appears to have been a further increase of 200 cars daily since the sliding scale of parking rates was made effective, February 12, 1964.

Since the scale of parking fees, based on the per cent of occupancy for each lot has become effective, the anticipated shift in parking volume from higher priced lots to lower priced lots has occurred. This has resulted, as shown in Table 5, in a much better distribution of available vacant spaces among adjoining lots with a result that each lot is more readily able to accommodate peak parking demand.

At Riverside and Woodland, where the parking rates had always been the same, a 15¢ difference in parking fee was established by making Woodland 25¢ and Riverside 10¢. Previously Woodland, which has more visible access from the highway than Riverside, was frequently full before 8:30 in the morning resulting in a large number of cars being turned away by the "no vacancy" sign. A spot check suggested that these cars, upon discovering that no space was available at Woodland, did not return to Riverside but continued on toward Boston. Since there were no vacancies at any other MTA lots between Woodland and Boston, it is to be supposed that these customers were lost for that day.

Riverside with a slightly less visible, but no less direct, access route had 1200 empty parking spaces. The result of creating an imbalance in parking rates between the two locations was that there was an immediate increase of 160 cars at Riverside. While the major impact of a change in parking rates seems to take effect within two or three weeks after the new rates are announced, Riverside continues to grow in popularity as an MTA parking lot and Woodland is parking almost as many cars as it was prior to the experiment in 1962. Since January, 1963, the average daily number of cars parked at Riverside has risen from 250 to 750. It would appear that on lines such as the Mattapan line where all of the available parking spaces are now occupied, consideration should be given to increasing the number of available parking spaces at lots where MTA owned land is available, as well as to improving access to other lots.

In conclusion, it would seem that the only present limit to "Park and Ride" patronage is the number of spaces that are available, and that given carefully selected parking fees, the public can definitely be induced to patronize these lots. The 5,000 odd cars now using MTA "Park and Ride" facilities, located well outside of the downtown area, represent one-fifth of the number of cars which can be accommodated by parking spaces in the Central Business District. It is to be noted in this connection that parking lots adjacent to rapid transit stations can be constructed at considerably less cost than downtown parking facilities.

2. *Parking at Drive-In Theaters*

In contrast to the results of the reduced fee "Park and Ride" experiment, the program using drive-in theaters connected to the downtown area by express bus service failed to attract substantial patronage.

In the Greater Boston area, arrangements were made to use three drive-in theaters located adjacent to major expressways as daytime parking lots, while regular movie showing

continued each evening. At the outset there was much skepticism as to the practicality of using someone else's theater as a daytime parking lot, while little attention was devoted to whether or not such an express bus service could generate an adequate volume of ridership. The results prove extremely interesting. Few, if any, operational problems were encountered. Passengers were also rather scarce.

The operating company executed agreements with the owners of the drive-in theaters which provided that the theater would be opened from early morning until early evening with an attendant on duty to collect a fee covering the all day parking charge and the round trip fare to Boston. The drive-in theater owners kept the income from the parking fee, turning over to the carrier the revenue collected from the sale of bus tickets. Drivers were warned of the necessity of removing their cars before 7:30 p.m. in order to make room for the evening movie customers. In the rare instances in which cars were left later than 7:30 the car owners were charged regular movie admission prices before being allowed to reclaim their cars.

The rationale behind the choice of outlying drive-in theaters as parking lot locations was that the all day "Park and Ride" fee, including round-trip bus fare, which was set at $1.00, would be substantially cheaper than the parking fee at downtown lots where all day charges of $2.00 and more are not uncommon. It was immediately apparent from interviews with patrons, however, that there was little incentive for automobile commuters to leave an expressway, only to board a bus which returned them to the very traffic jam which they might have been trying to escape.

It appears, therefore, that the cost factor was not foremost in the minds of the automobile commuters in the areas covered by the drive-in theater experiment. These patrons seemed only vaguely aware of the real cost of operating their automobiles and they tended to base their cost estimates almost entirely on out-of-pocket expenses such as parking fees or tolls. What seems to be uppermost in the automobile commuter's mind is speed. This is underscored by the success of the rapid transit parking lots which offer a fairly steady, uninterrupted 25-mile an hour journey through a segment of the city where highway speeds are considerably lower.

The success of the operational aspects of using drive-in theaters as daytime parking lots for commuters suggests that urban transportation companies might be able to achieve a very desirable second income from large parking areas which are proposed for terminals at the end of forthcoming rapid transit extensions. It might be possible to consider designing these areas, whose plans calls for 1500 to 2000 parking spaces to double as drive-in theatres. Located at the confluence of several major highways, they would seem to be ideal for such a double utilization of available space.

B. Origin of "Park and Ride" Commuters by Community

During the month of February 1964, MTC field staff completed an inventory of automobiles using MTA parking lot locations. In all, 34 lots were surveyed and the registration number of every car parked at these locations was recorded. Through the cooperation of the Registry of Motor Vehicles, whose files were made available to the MTC, it was possible to note the town of registration for each automobile recorded. The home towns of 4,800 commuters were checked in this manner. The results proved extremely interesting. Maps in Chapter 7 show the total distribution by line or sector. It is not surprising to note that cars parked at lots along a particular line are registered from communities distributed along major highways in the sector of the Metropolitan Boston area served by the line where the cars parked.

While the residents of 14 cities and towns pay the annual cost of MTA operation, the cars parked at the MTA parking lots included cars from 182 Massachusetts cities and towns.

The most substantial number of park and ride commuters were from the North and South shores, and from the western corridor comprising Wellesley, Natick and Framingham. Of the 4,800 cars surveyed (an 85 per cent sample of cars using MTA and private "Park and Ride" lots) two-thirds of the cars were from outside the MTA district. One or more cars were found from 136 of the 144 cities and towns on the maps. It is clear that the MTA serves not only the residents of the 14 cities and towns but is of importance to residents of nearly all the communities throughout the eastern half of the state (Table 6).

In order to validate and correlate this survey of 4,800 cars parked at rapid transit parking lots, the MTC field staff also completed a survey of 5,600 cars which were parked at 12 multi-level off-street parking garages in downtown Boston. The results of this survey are presented graphically in Figure 24. Of the 5,600 cars whose registrations were traced at the Registry of Motor Vehicles, 3,300, or 58 per cent were from outside the 14 cities and towns. The fact that the percentage of cars from outside the MTA district is lower for cars using downtown garages than for cars using MTA parking lots suggest that the MTA park and ride lots are somewhat more attractive to persons making relatively longer journeys, while persons traveling shorter distances to Boston prefer more frequently to travel all the way downtown. The 5,600 cars surveyed were found to be registered in 240 Massachusetts cities and towns, including nearly every community in the eastern half of the State.

TABLE 6

METROPOLITAN TRANSIT AUTHORITY
ORIGIN OF MTA PATRONS

City or Town	U.S. Census 1960 Populotion	U.S. Census 1960 Lobor Force	% of Deficit Poid 1940 Formulo	% of District Population	% of Labor Force in District	Number of MTA Riders (Wilbur Smith)	% of District Riders (Wilbur Smith)	% of Totol Riders (Wilbur Smith)
Arlington	49,953	21,063	1.883%	3.493%	3.413%	3,599	1.519%	1.304%
Belmont	28,715	12,228	1.092	2.007	1.981	3,741	1.578	1.355
Boston	697,197	303,367	64.382	48.748	49.196	147,231	62.141	53.347
Brookline	54,044	25,624	3.096	3.779	4.152	13,116	5.535	4.752
Combridge	107,716	47,972	8.310	7.532	7.774	20,884	8.814	7.567
Chelseo	33,749	13,191	2.017	2.360	2.137	3,656	1.543	1.329
Everett	43,544	18,555	2.328	3.045	3.007	4,504	1.900	1.631
Molden	57,676	24,340	3.368	4.033	3.944	5,003	2.111	1.812
Medford	64,791	27,401	3.213	4.543	4.440	6,710	2.832	2.431
Milton	26,375	10,712	0.776	1.884	1.736	3,099	1.307	1.122
Newton	92,384	38,073	0.791	6.460	6.170	9,663	4.078	3.501
Revere	40,080	16,234	1.635	2.802	2.630	4,415	1.863	1.599
Somerville	94,697	40,973	5.004	6.621	6.640	8,425	3.555	3.052
Wotertown	39,092	17,112	1.291	2.733	2.773	2,884	1.217	1.044
	1,430,193	617,045				236,930		
Brointree						1,289		.467
Dedhom						1,181		.427
Lynn						1,450		.525
Melrose						1,731		.627
Quincy						5,362		1.942
Wellesley						1,152		.417
Winthrop						3,075		1.114
128 Other Towns						23,814		8.628
						275,984		

Origin: Wilbur Smith & Associates

Appendix C

MTC:

Demonstration Project Chronology

July 14, 1959 Creation of Mass Transportation Commission by Act of Massachusetts Legislature, Chapter 416. The Act provides: "The Commission shall study mass transportation problems and plan co-ordinated mass transportation facilities and policies affecting the commonwealth, the metropolitan Boston area and the city of Boston."

May, 1961 MTC submitted a report with accompanying legislation to the General Court of Massachusetts requesting the establishment of a Joint Recess Transportation Committee.

June 2, 1961 MTC received approval from Housing and Home Finance Agency (HHFA) for Urban Planning Assistance Grant of $75,000 for half of cost of P-24 (subsequently increased to $100,000 — two-thirds of project cost). P-24 was a preliminary survey and analyses of a greater Boston region including 144 cities and towns.

Dec. 12, 1961 MTC voted to authorize Dr. Joseph F. Maloney the Executive Director of MTC, to apply, on behalf of the Commission for HHFA demonstration and planning grants.

Dec. 12, 1961 MTC and Joint Legislative Recess Committee on Transportation jointly released summary recommendations for initiation of an integrated demonstration and planning program. Statements of support were included from Governor Volpe, Speaker McCormack, Attorney General McCormack, Mayor Collins and various other civic leaders.

January, 1962 MTC and Joint Legislative Recess Committee on Transportation filed a formal joint report with Legislature. Report was background basis for MTC application for Demonstration and Planning Projects.

May 3, 1962 MTC submitted a revised application for an Urban Planning Assistance Grant by the HHFA (Mass P-34), undertaken in the revised form with the cooperation of the Department of Public Works. The project is to result in a preliminary comprehensive plan for the Boston region. Total Boston Regional Planning Project (BRPP) budget is $4.8 million.

May 17, 1962 MTC submitted a revised application for a Mass Transportation Demonstration Grant of $3.6 million to the HHFA Office of Transportation. This grant was requested for the purpose of undertaking a series of mass transportation experiments with railroads, private bus companies and the MTA. The Demonstration Project was to be budgeted at $5.4 million. The duration of the project would be approximately 18 months.

May 28, 1962 HHFA approved MTC request for Urban Planning Assistance Grant (Mass P-34) as submitted on May 3, 1962.

July 23, 1962 General Court provided funds for the special program for Mass Transportation Demonstration and Planning Programs by the Mass Transportation Commission.

September 28, 1962 HHFA approved MTC request for a Mass Transportation Demonstration grant of $3.6 million as applied for on May 17, 1962.

November 18, 1962 Boston and Maine Railroad contract signed; experimental service to begin in January 1963.

November 27, 1962 Systems Analysis Research Corporation retained to assist MTC in evaluating and reporting on the railroad, MTA and bus demonstration experiments.

December 10, 1962 Eastern Massachusetts Street Railway Company began reduced fare, off-peak experiment within a 1.5 mile radius of downtown Lowell.

December 17, 1962 Service Bus Line, Inc. began new service from Malden to Revere Beach.

December 26, 1962 Joint Special Legislative Committee on Transportation submitted report to the Legislature. This report recommended that the General Court petition Congress to speedily enact President Kennedy's mass transportation program. Further urged that the results of the Demonstration Project be in sufficient form by the end of 1963 to permit early legislative action on the preservation of railroad commuter service extensions of rapid transit, and possible restructuring of the MTA. The report concluded:

> "We are confident that every effort will be taken to make certain that the entire program is done in a completely objective manner without any partisanship, whitewashing or witch-hunting, and without the establishment of any large staff that would have built within it the bureaucratic tendency toward self-perpetuation rather than the rapid completion and finalization of the entire program in the most efficient and competent manner.
>
> "This Committee believes that its collaboration with the Mass Transportation Commission has clearly been not only successful but also precedent-setting for the country as a whole."

December 31, 1962 As of the end of 1962, contracts with four major carriers (Boston & Maine Railroad, Service Bus Company, Eastern Massachusetts Street Railway Company, Johnson Bus Company) had been signed for a total of $2,288,000.

January 2, 1963 Johnson Bus Line began increased service experiment between Boston and Milford.

January 7, 1963 Boston & Maine Railroad began new service. 21.4 per cent increase in passenger service during first month of experiment operation.

January 14, 1963 Lynnfield Community, Inc. began increased service from Wakefield to Lynn.

January 28, 1963 McKinsey and Company retained to develop data on costs of railroad commuter service to determine from operational experiments the gains and losses in commuter traffic and revenues and the cost associated with varying levels of service and fare structures.

February 15, 1963 Demonstration Progress Report No. 1 issued.

March 9, 1963 Eastern Massachusetts Street Railway Company Lowell experiment concluded.

March 11, 1963 New Haven Railroad inaugurates new experimental service.

Berkshire Street Railway Company began experimental routes and increased service in Pittsfield, Williamstown, Adams and North Adams.

Fitchburg and Leominster Street Railway Company began six experiments in Fitchburg, Leominster, Ashby, Townsend and Lunenburg.

Massachusetts Northeastern Transportation Company began new service, route extensions and increased service in the Merrimac Valley area.

March 23, 1963 Lynnfield Community's increased service experiment from Wakefield to Lynn concluded.

April 1, 1963 MTA began reduced fee experiment at parking lots.

April 10, 1963 Demonstration Progress Report No. 2 issued.

April 18, 1963 Joseph Napolitan Associates, Incorporated retained to organize, direct and execute a survey of commuter habits on certain trains of the Boston & Maine Railroad.

April 22, 1963 Brush Hill Transportation Company began new service from Stoughton to Route 128 New Haven Station.

May 1, 1963 Johnson Bus Line experiment transferred to The Short Line, Inc., due to acquisition of Johnson by The Short Line, Inc.

June 1, 1963 Contracts with cumulative total of eleven carriers executed, for total amount of $4,964,000 (Fitchburg & Leominster Street Railway Company, Massachusetts Northeastern Transportation Company, Lynnfield Community, Inc., Berkshire Street Railway Company, New Haven Railroad, Metropolitan Transit Authority and Brush Hill Transportation Company).

June 5, 1963 Berkshire Street Railway Company experiments concluded.

Yellow Coach Line, Inc. continued new and increased

service experiments in Pittsfield, Adams, North Adams and Williamstown, heretofore provided by Berkshire Street Railway Company.

June 23, 1963 MTA began new service from North Station to MIT and East Cambridge; inner circumferential route from Dudley Station to Sullivan Square; increased service from Sullivan Square to Medford; outer circumferential from Ashmont to Harvard Square and increased service from North Station to South Station.

June 24, 1963 Eastern Massachusetts Street Railway began new service from Topsfield to Salem.

June 25, 1963 Demonstration Progress Report No. 3 issued.

July 1, 1963 Barre Bus Company began experiment: increased service from Rutland to Holden to Worcester.

July 15, 1963 The Short Line, Inc. began experimental service from Worcester to Uxbridge.

July 17, 1963 MTC conducted a technical conference with HHFA officials, representatives of carriers participating in the experiments, representatives of consultants to MTC, representatives of public agencies and Boston Regional Planning Project staff. Progress review of:

1. Boston & Maine Railroad experiment
2. MTC-Napolitan Commuter Passenger Survey
3. MTA Parking Experiments, MTA Bus Experiments
4. Private Bus Experiments
5. Community Relations
6. Planning Inputs and Planning Liaison

July 23, 1963 Service Bureau Corporation retained to compile passenger and revenue audits from material supplied by New Haven Railroad.

August 1, 1963 Eastern Massachusetts Street Railway Company began fare reduction experiment.

Eastern Massachusetts Street Railway Company began increased service in Fall River.

Second phase of the B&M railroad experiment began, fares returned to just below pre-experiment level for commuters and fares for off-peak commuters were further reduced. Service frequency remains unchanged.

August 15, 1963 Yellow Coach Lines, Inc. increased service Adams-North Adams and North Adams-Williamstown concluded.

August 19, 1963 Eastern Massachusetts Street Railway Company began new service from Boston to Lawrence.

August 31, 1963 Fitchburg and Leominster Street Railway Company experiments to Ashby and Townsend concluded.

Massachusetts Northeastern Transportation Company four service experiments concluded.

September 3, 1963 MTA began drive-in theater parking lot experiments with express service and new bus service between Boston College and Kenmore Square.

September 8, 1963 Second phase of New Haven experiment began, consisting of retaining the off-peak increased frequency on the Providence Line and further reducing off-peak fares in a pattern similar to those instituted in the second phase of the B&M experiment.

September 18, 1963 Demonstration Progress Report No. 4 issued.

October 19, 1963 Massachusetts Northeastern Transportation Company — Newburyport-Amesbury experiment concluded.

November 2, 1963 Brush Hill Transportation Company experiment concluded.

November 4, 1963 Joseph Napolitan Associates, Incorporated, retained to conduct a survey to determine factors which influence the public's choice of mode of transportation.

November 17, 1963 Service Bus Company experiment concluded. Company continues 40 per cent of experimental service as part of regular service. Eastern Massachusetts Street Railway, Topsfield to Salem experimental route concluded.

November 22, 1963 Demonstration Progress Report No. 5 issued, with preliminary and tentative staff conclusions.

November 28, 1963 MTA Inner Circumferential Route E-3 concluded.

MTA Route E-4 — Elm Street, Medford to Sullivan Square, Charlestown, concluded.

MTA Revere Drive-In Theatre Experiment, E-11, concluded.

December 4, 1963 Yellow Coach Lines, Inc. — new service to Francis Plaza Shopping Center concluded.

December 28, 1963 MTA Route E-2 (North Station-M.I.T.) concluded.

MTA Route E-5 (Ashmont-Harvard Square) concluded.
MTA Route E-6 (Ashmont-Reservoir) began.
MTA Route E-8 (Fresh Pond Drive-In Theater in West Cambridge with rapid transit terminal Harvard Square) concluded.
MTA Route E-9 (Boston College-Kenmore Square) bus service paralleling the existing street car service experiment concluded, but service continued by MTA.

Dcember 31, 1963 The Short Line, Inc. (Johnson Bus Lines, Inc.) Boston-Milford experiment concluded.

First phase of Eastern Massachusetts Street Railway Company, North Shore, reduced fare experiment concluded.

January 4. 1964 B&M Railroad operation returned to 1962 level of service for one week end and Monday.

January 7, 1964 Third phase of B&M Railroad experiment began, retaining the same fare structures as in phase two and some service revisions to tailor service to meet the demands which appeared evident from the first two phases.

January 12, 1964 Eastern Massachusetts Street Railway Company began second phase of North Shore reduced fare experiment.

January 15. 1964 Yellow Coach Lines, Inc. (Waconah Heights-Wilson Park Housing and Green Ridge Housing Development) experiment concluded.

February 9, 1964 Eastern Massachusetts Street Railway Company (Fall River) experiment concluded.

February 12, 1964 MTA Parking Lots — reduced fee experiment concluded. Sliding scale of parking fees introduced by MTA management.

February 15, 1964 Eastern Massachusetts Street Railway Company — (Lawrence-Boston) experiment concluded. Company retains 75 per cent of experimental service as new part of regular service.

February 29, 1964 Fitchburg and Leominster Street Railway Company experiments concluded.

Project #1 — Fitchgate Shopping Center

Project #4 — Industrial Plant Service

Project #5 — Main Line Fitchburg & Leominster

Project #6 — Route Extension in Fitchburg

Barre Bus Company increased experimental service (Worcester-Rutland) concluded.

March 6, 1964 New Haven Railroad experiment concluded.

March 21, 1964 B&M Railroad concluded experiment and returned to pre-experiment fares and service levels. Within two weeks after the conclusion of the experiment peak patronage had dropped 11 per cent and off-peak 34 per cent, as compared to the last week of the experiment. This represents a loss of 64 per cent of all the new riders gained during the experiment.

March 28, 1964 Metropolitan Transit Authority remaining experiments concluded:

E-6 Ashmont-Reservoir

E-7 North Station-South Station

E-10 Neponset Drive-In Theater Parking

The Short Line, Inc. (Uxbridge-Worcester) experiment concluded.

April 11, 1964 Joint Legislative Recess Committee on Transportation submits its report calling for state payments to B&M for 5-year maintenance of phase three level of B&M service and fares, on basis of MTC Demonstration Project Progress Reports. Report also recommends MTA rapid transit extensions, the inclusion of 78 communities in an expanded MTA district and interim assistance to private bus companies throughout the Commonwealth.

April 21, 1964 Special gubernational message on transportation, recommending enactment of a comprehensive legislative program.

June 17, 1964 Massachusetts Legislative passes comprehensive Mass Transportation Bill.

June 18, 1964 Governor Endicott Peabody signs Mass Transportation Bill.

ENDICOTT PEABODY
GOVERNOR

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE DEPARTMENT
STATE HOUSE, BOSTON

June 22, 1964

Honorable Joseph W. Martin, Jr.
Capitol Building
Washington, D. C.

Dear Congressman Martin:

I have just learned that H.R. 3881 is scheduled for vote on June twenty-fifth. The passage of this legislation is vital to Massachusetts and I do solicit your favorable consideration of this matter. It is an important link in the effectuation of my own mass transportation legislation which has already been signed into law.

Mass transportation is an area where federal-state participation can achieve manifold benefits and truly conquer new frontiers.

Massachusetts has achieved significant firsts in this field; it was the first and only State to have an HHFA Office of Transportation Demonstration Projects grant of $5.4 millions on a 2/3 federal-1/3 state basis administered by the Mass Transportation Commission.

It was the first State to submit to a legislature a comprehensive and statewide mass transportation program -- and with enactment of H.R. 3881, it can be the first State to qualify and to implement this legislation.

Since a statewide cigarette tax helps to pay for this program, every Congressman will be able to benefit his constituents by obtaining reimbursement to the State for its share of the cost.

For these reasons, I hope you will forge another important link in federal-state cooperation with your vote for H.R. 3881.

Sincerely,

Endicott Peabody
Governor

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